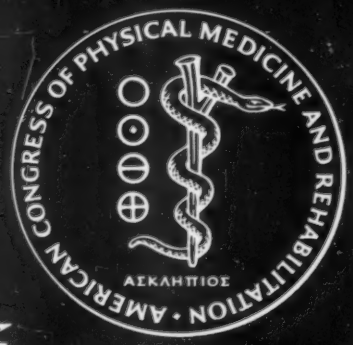

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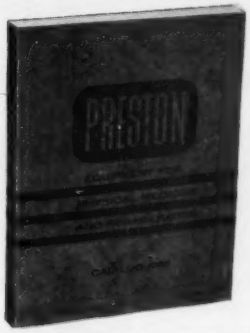

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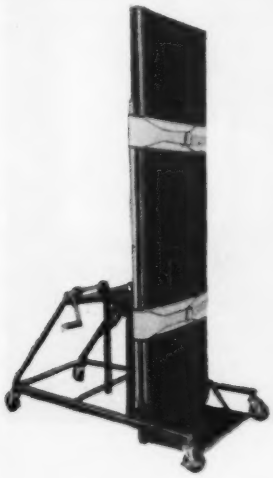

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I wonder if any of you remember that great scene from "The Wizard of Oz" . . . when Frank Morgan, portraying a balloon ascentionist, rose majestically from the little fairground in Kansas . . . and suddenly lost control of his balloon. There he was, floating away majestically, but wondering how he was ever going to get down.

Well, that's sort of the way I've felt a few times this year as I endeavored to fill this space each month. I could feel myself soaring away into all sorts of clouds of nouns, verbs and adjectives . . . and then wondering how I was going to get down again. As I mentioned last January, in the first of this series, I wanted to share some of my thoughts with my many friends in the Physical Medicine profession . . . rather than just have pages filled with pictures of machines with which you were already familiar.

Each month, when the time comes to write this effort, our Advertising Manager nervously shuffles his graphs and textbooks and tells me that it would be wonderful if we had a picture of a Diathermy somewhere . . . or at least a drawing of an Ultrasound. Each month I patiently explain to him that the Physiatrists that read Archives of Physical Medicine are more familiar with these instruments than he ever will be . . . and, therefore, it sort of becomes somewhat redundant to tell you anything about why we're among the world's largest manufacturers of Physical Medicine equipment.

But, before I get sidetracked on *that*, I did just want to say that it has been very enjoyable to communicate with you this way over the past year. I hope you have found time to occasionally join me on this page . . . and that you enjoyed reading these just one-tenth as I enjoyed writing them.

I'd like to try it again next year . . . or at least, I'm considering it. If you have just a moment, I would very much appreciate hearing from you . . . by letter or postcard . . . and let me know what you think. Would you prefer seeing straight product ads? . . . or do you like this type better? (And, I promise to abide by your decision!)

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50 Card Test: Clerical Task as a Screening Device for Organic Brain Damage. Report on Preliminary Findings

Aaron Kameny
New York

● A clerical task is described involving the alphabetic filing of cards (50 Card Test or the Clerical Task). It is a short, easily scored test which may prove of potential value as a screening device for patients suspected of having organic brain disease; an objective measure of recovery from organic brain disease: the patients' clinical improvement to be correlated with the scores obtained on the Clerical Task and a means of assessment of intellectual functioning in children beginning with the age of 10 years and the fifth elementary school grade.

Numerous diagnostic tests for the assessment of organic brain damage have been developed. The tests of Pierre Marie[1] and François Moutier[2] at the beginning of the 20th century are among the earlier important contributions in this area. These were subsequently augmented by Bender,[3] Goldstein,[4] Chesher,[5] Schuell,[6] and others.

Some of these tests are designed primarily for aphasia, while others are concerned with general signs of cerebral deficit or with disturbances involving perceptual and visuomotor functions.

Semmes, Weinstein, Ghent and Teuber,[7,8] in 1955 and 1956 jointly published the results of their investigations of spatial orientation and tactile function in patients with parietal lobe lesions.

A series of geometric figures which they were required to reproduce were presented tachistoscopically to normal subjects and to psychiatric patients by Brengelman.[9] He found that psychotic patients differed significantly in the degree of rotation in their designs as compared with psychoneurotic and normal subjects.

Kahn[10] provides a basic set of practice material on alphabetic filing (720 names on cards) as a supplement to his book. Otis[11] and Chesler[12] have constructed tests for filing and alphabetizing as measures of clerical skill. Chesler's test contains 45 sets of five names from A to Z.

No published reference has been found by the author to any clerical task involving the alphabetic filing of a series of random words as an aid to diagnosis of patients with cerebral lesions.

Background of the Study and Early Observations

The idea for this investigation stems from an attempt to develop a clerical task suitable for prevocational screening of some of our hospital patients.

In a preliminary trial this task was administered to three brain-damaged patients. Their performance was marked by the following features: a number of errors by filing words by the wrong alphabetic index letter (errors of the first order); a still higher number of errors made by filing words in the wrong sequence within a given index letter (errors of the second order). The errors of the second order were: (a) *irregular*, as seen in the filing errors of normal subjects and (b) *inverted*. Normal subjects would file the words *cat, chair, cheese,* in the order given. The subjects in this group filed them in the following order: *cheese, chair, cat (inverted).* These subjects did not use a consistent direction in filing the cards *(rotation).*

This specific pattern was manifested persistently in all of the 15 trials of the three brain-damaged patients. On the basis of these observations the author was considering the possibility that errors of the first order and an even higher percentage of errors of the second order, coupled with an inverted pattern as well as rotation of cards, may be associated with organic brain damage.

The Clerical Task (Filing Random Words Alphabetically)

Each subject is presented with a set of 50 three by five inch white index cards

Rehabilitation Counselor, Department of Physical Medicine and Rehabilitation, Montefiore Hospital.

containing single words in large, black, lower case letters. The file box, 15" by 5½" by 3½", is equipped with a gray alphabetic index, facing each subject.

A list of 1000 words, based on Walpole's *Golden Dictionary,* was randomized and broken into stacks of 100 words and further subdivided into groups of 50. To eliminate the possible effect of memory a new group of 50 words was presented at each trial.

The cards are presented with the following instructions: "I would like you to arrange these words in alphabetical order and file them in this box. Most people find it easier first to put all of the words which belong to one index letter in one stack and all of the words which belong to another index letter in another stack. When you have all of the this file box" (pause), "all right?" words arranged in this way, file them in (pause), "Go ahead, please".

The Scoring

The following aspects of the performance are scored:

1. Time required
2. The number of cards misfiled by index letter, *errors of the first order*
3. The number of cards misfiled *within* a given index letter, *errors of the second order*

The errors of the second order may be either:

a. irregular, or

b. inverted

Notice was taken of the direction in which the cards were faced. It generally has been observed that there is a preference for each person in the direction in which he will arrange a series of articles, or e.g.: draw a person in profile, i.e.: contralateral to his handedness.

The placement of cards contrary to this expected direction is termed rotation in this report.

Composition of the Sample

The initial group of 10 subjects (three patients with brain damage and seven normal subjects) was increased to 136 normal control subjects and 15 experimental subjects (brain-damaged patients).

Experimental Group

The experimental group consisted of 15 brain damaged patients (all right handed); of these 10 were classified by the author as having severe brain damage and five as having mild deficit. This distinction was based on the presence of marked impairment of motor function combined with deficit in language, cognitive, and perceptual functions in the severely affected group; a mild or moderate impairment of motor function with little or no deficit in language or other functions in the mildly impaired group.

The following data on localization were found on the 15 patients:

Left internal carotid artery occlusion	1
Basilar artery syndrome	1
Left frontal lobe (tumor)	1
Parietal lobe	1
Left internal capsule	1
Left middle cerebral artery	1

The remaining nine cases were only classified as:

Left sided cerebrovascular occlusion	5
Right sided cerebrovascular occlusion	4

The etiology of the cerebrovascular accidents in these 15 cases was highly diversified and can be divided into:

Arteriosclerotic vascular disease (insufficiency, hemorrhage, thrombosis)	3
Aneurysm with hemorrhage	1
Demyelinating disease	1
Diffuse vascular changes, etiology undetermined	1
Hypoglycemia with seizures	1
Hypertensive cardiovascular disease and hemorrhage	3

Control Group

This group contained 20 hospital employees, 15 hotel guests, 32 arthritic patients, 14 school children and 55 student nurses, a total of 136 subjects.

Results

To obtain an indication as to the age level at which a child can perform the Clerical Task adequately, 20 trials were obtained on 14 school children, aged eight to 16 years. Five of these, whose ages ranged from eight years to nine years and six months, were unable to perform this task effectively. They made massive errors at a rate as high

Table 1: Time Consumed in the Completion of Task

	Number	Mean Time	Range
Student Nurses	55	7' 49"	4' 5" - 19' 12"
Arthritic Patients	32	14' 25"	4' 8" - 20' 2"
Children	14	11' 41"	9' 18" - 20' 2"
Hotel Guests	15	5' 19"	4' 8" - 9' 0"
Hospital Employees	20	5' 16"	3' 1" - 10' 21"
Patients with Severe Cerebral Damage	10	17' 12"	6' 7" - 34' 13"
Patients with Mild Cerebral Damage..	5	10' 8"	6' - 18' 2"

as 55 to 70 per cent. Even when given a pre-trial demonstration on alphabetic filing, the rate of error still remained at the 50 per cent level, or higher. The youngest child to perform this task adequately was 10 years and 5 months old.

Provisionally, based on the findings in this group, the minimum educational requirement for this task was set at the fifth grade level.

The hotel guests who were of a higher educational level than the experimental group attained the highest scores; the next highest scores were achieved by hospital employees, who in turn were of a slightly higher educational level than the experimental subjects. Student nurses, who were of a similar educational level, were third in their scores, followed by the arthritic group. The 32 arthritic patients most closely parallel the experimental subjects. Both groups stem from the same cultural background, socioeconomic level, are of the same vocational experience, age and education. This arthritic group included three patients aged 71, 72 and 75. When these patients were excluded the mean age for the arthritic group was 45.2 and the range 29 to 68 while that of the brain-damaged patients was 45.2 and range 29 to 62.

Time Factor

The time requirements for the Clerical Task by the Controls and the Experimental Group are given in table 1.

No time limit was set for the performance of the Clerical Task. Based on observations on 136 controls and 15 experimental subjects, it is estimated that the requirements for normal subjects should be somewhere between four and 10 minutes.

From observation it was apparent that a number of arthritic patients were slowed down by arthritic process and also by advanced age. It should be pointed out, however, that advanced age does not preclude successful performance, in the absence of intellectual deficit. There were some arthritic patients, aged 70 and older, whose performance surpassed that of a number of far younger persons.

Errors of the First Order

The number of such errors was relatively small among all of the groups tested, and the difference cannot be considered statistically significant; (there were none found among hotel guests and hospital employees).

Errors of the Second Order, Irregular

These errors were lowest among hotel guests (an average of .1 error per person) and highest among persons with severe cerebral damage (an average of 20 errors per person tested). There is a statistically significant difference with respect to errors of the second order made by patients with severe cerebral damage, and by each of the control groups.

As far as irregular errors of the second order were concerned, there was no statistically significant difference between patients with mild cerebral damage and most of the control groups.

Table 2: Distribution of Errors

No. of Subjects Tested		Errors of the First Order		Errors of the Second Order, Irregular		Errors of the Second Order, Inverted	
		$\bar{X}$ Mean	$\frac{\delta}{\sqrt{N}}$ Stand. Dev. of the Mean	$\bar{X}$ Mean	$\frac{\delta}{\sqrt{N}}$ Stand. Dev. of the Mean	$\bar{X}$ Mean	$\frac{\delta}{\sqrt{N}}$ Stand. Dev. of the Mean
Student Nurses	55	0.4	0.2	4.9	1.1	0.09	0.02
Arthritic Patients	32	0.6	0.2	6.0	1.5	0.9	0.08
Children	14	0.05	0.05	7.0	2.5	0.2	0.3
Hotel Guests	15	0.0	0.0	0.1	0.1	0.0	0.0
Hospital Employees	20	0.0	0.0	1.0	1.2	0.0	0.0
Patients with Severe Cerebral Damage	10	1.3	0.3	20.0	1.5	1.5	0.6
Patients with Mild Cerebral Damage	5	0.1	0.1	2.4	0.4	0.4	0.1

Errors of the Second Order, Inverted

The data on such errors are summarized in column 3 of table 2. It should be recalled that an inversion is defined as the filing of a group of words (at least three) within a given index letter, systematically, but in an inverse order from the one expected. For example, the words *ball, bill,* and *butter,* filed in the sequence *butter, bill* and *ball* would constitute an error of inversion.

Errors of the second order, inverted, were not found among hotel guests and hospital employees. The mean number of such errors was less than .1 among student nurses, .2 among children, and .09 among arthritic patients. In none of the control subjects were these errors found on successive trials. However, the mean number of such errors, made by patients with severe cerebral damage was 4. Patients with mild cerebral damage made such errors at the rate of .4. Bearing in mind the small number of patients tested, there is a significant difference between the number of inverted errors made by patients with severe cerebral damage on the one hand, and the patients with mild cerebral deficit and each of the control groups on the other hand.

Rotation

Our interest in this phenomenon arose from observing a relationship between the direction of filing cards and the handedness of the subjects tested*.

Normal right handed subjects filed the cards facing to the left, while left handed persons placed them facing to the right. The direction chosen was with few exceptions maintained throughout each trial. A small number of subjects filed their cards standing upright in the file box, either clustering toward the center or standing against the left side of the box or to the right of it.

Studying the choice of direction in filing cards by patients with cerebral lesions, the following observations were made:

a. The patients first produced a zigzag pattern in the direction of filing cards; (this was in striking contrast to the performance of the controls who chose one direction for placing cards and usually maintained it consistently throughout).

b. As this test was repeated during the period of recovery this pattern changed, with a choice of a predominant direction but still varying the percentage of the cards facing in the other direction.

c. In those patients in whom the dominant hemisphere had been affected, a reversal in direction in which cards were initially placed was found after a period of rehabilitation.

*The choice of direction in relation to handedness will be discussed in greater detail in a forthcoming publication.

Discussion

It has been stated earlier that the Clerical Task (50 Card Test) involves the organization and arrangement of words in an ordered sequence and could therefore be classified as an intellectual task.

Bearing in mind the small number of experimental subjects, the results indicate that the brain damaged patients may be expected to show a significantly higher number of errors and a significantly longer time requirement on the performance of the task than normal subjects. There is also a significant difference as to number of errors and time consumption by patients with severe damage and those with mild impairment.

Changes in cognitive and perceptual functions in patients with cerebral lesions affect performance in various modalities. Tasks which included sorting and arranging words in a ranking ordered sequence proved particularly difficult for them, as seen by their performance on the Clerical Task. Such patients also have difficulty in the correct use of words which denote direction — *right, left, up, down, front, back.* Further manifestations of this directional impairment are seen in: transpositions and reversals in writing, and reversals of the hands of the clock in the clock setting series (for example: instead of setting them at 3:15 they reverse the direction by rotating both hands counterclockwise a full 180 degrees setting them at 8:45). It is the impression of the author that the inconsistencies in direction in filing cards represent a related phenomenon.

Those patients who had severe impairment found the task difficult and made massive errors distributed in a pattern characteristic for that group. Those with even greater impairment were totally incapable of carrying out the task and abandoned it usually after they filed only one third of the 50 cards. Compared with the group of children, the subjects with the most extensive cerebral damage could not do what an eight-year-old child below the fourth grade in school could achieve, namely arrange the words according to the initial letter only. The pattern of the errors of the children differed from that shown by the patients. The children were slow at the task and required about as much time as the patients with mild cerebral damage.

Summary

In this paper a clerical task is described involving the alphabetic filing of cards (50 Card Test or the Clerical Task). It is a short, easily scored test which may prove of potential value as:

a. A screening device for patients suspected to have organic brain disease.

b. An objective measure of recovery from organic brain disease: the patients' clinical improvement to be correlated with the scores obtained on the Clerical Task.

c. A means of assessment of intellectual functioning in children beginning with the age of 10 years and the fifth elementary school grade.

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Information relative to securing reprints of this study may be had by checking the Reader Service column on page iv of this issue.

VERY IMPORTANT

The next examinations, written and oral, of the American Board of Physical Medicine and Rehabilitation will be held in Chicago on June 29 and 30, 1962. The final date for submitting application is February 15, 1962. Write to the Secretary, Dr. Earl C. Elkins, 200 First Street, S. W., Rochester, Minnesota, for application.

Effect of Percutaneous Medication on Muscle Tissue: An Electromyographic Study

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● The question whether percutaneous absorption of medicine really occurs is an old one. Whether medicines applied to the skin have any effect on the deeper tissues, especially muscle, and whether they penetrate into and through the skin into the blood stream have long been debated. An effort to measure the effect of percutaneous medication on muscle with the electromyograph has been made, and the following conclusions have been reached: Percutaneous absorption does take place. Rubefacients applied to the skin do have a definite effect on muscle, increasing the time required to fatigue a working muscle.

There has been a long standing controversy among physicians as to whether medicines applied to the skin have any effect on the deeper tissues of the body, especially muscle. Whether percutaneous absorption of medicine really takes place (i.e., whether substances penetrate into and through the skin into the blood stream) also has been much debated.

A review of the literature on percutaneous absorption suggests that knowledge of the subject may be divided into three periods. The first period antedates 1877 and covers about one hundred years, during which much of the evidence was accepted as indicating that a large number of substances, chiefly gases and volatile chemicals, penetrate the skin freely. The second period extends from 1877 until 1900, during which Fleischer's[1] school of thought was dominant. Fleischer concluded that the skin of man and the higher animals is absolutely impermeable to all substances. The third period dates from 1900 to the present. During this era the theory of absolute impermeability has declined, and the observations of Schwenkenbecher,[2] that the skin is permeable to solutes in lipids and to substances in the gaseous state, but is practically impermeable to water and electrolytes, have gained acceptance.

There are believed to be two main pathways for penetration and percutaneous absorption. These are the transepidermal and transfollicular routes, according to Rothman.[3] The transepidermal route is not believed to be the major one for most substances. Rein[4] demonstrated the presence of a superficial barrier for water and electrolytes in the human epidermis (stratum lucidum).

Szakall[5] recently isolated this barrier layer by using Wolf's[6] cellophane tape technic. To what extent the epidermal barrier hinders penetration and absorption has not been clarified, because in most experiments epidermal and transfollicular routes have not been differentiated. However, even if the barrier is not absolute, Loeffler and Thomas[7] have shown that it effectively hinders the penetration of electrolytes.

The theory of a transfollicular route of percutaneous absorption, according to the majority of workers, best explains the mechanism of drug absorption. This theory takes into consideration the solubility of the drug in sebum. In the upper portion of the follicular canal, the hair shaft does not adhere to the follicular wall, and a space filled with horny scale and air is left. This interspace is continuous with the duct of the sebaceous gland. The sebum from this duct eventually enters the interspace, according to Ormsby and Montgomery.[8] Therefore, any medicament soluble in sebum may penetrate this space and reach the inside of the sebaceous gland, the membrane of which is more permeable than the epidermal barrier. Similarly, the wall of the follicular sheath is less resistant to penetration than the surface epidermis. From the sebaceous glands and hair follicles, medications may penetrate downward into the corium and from there by-pass the barrier and enter the blood stream. MacKee and associates[9] and other workers[10] demonstrated this by detecting the presence

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of tracers in the deeper parts of the hair follicles and in the sebaceous glands.

Being firmly convinced that percutaneous absorption is an effective means of depositing medicine in the deeper tissues, I have undertaken a study of some of the effects of such medication on fatigued muscle tissue. The problem presented many barriers and pitfalls because of the variables involved. Muscles vary in size, strength and development in different persons. Muscular action is usually the sum total of action by groups of muscles, not individual muscles. There is also the problem of applying medicine without adding massage to the therapy. In order to carry out this experiment, it was necessary first to establish a base line on which all reactions could be compared and evaluated. This presented the greatest hurdle, since heretofore it has been impossible to judge accurately the precise time at which a muscle in vivo is fatigued. Each of the variables was dealt with in such a manner as to overcome its effect on the results. Methods of doing this will be described in their appropriate places.

It was decided that the electrical amplitude of muscular action potentials could be used as a parameter for measurements of fatigue. An electromyographic technic using the triceps brachii muscle as the effector organ was chosen because this is the only muscle on the back of the arm, the anconeus below it being in reality simply a slightly separated part of the triceps and of little functional importance. The triceps has good power, with excellent electrical output, and it is covered only by skin and fascia, which leave it easily accessible to electrodes. Also, it can be fatigued easily. The act of extension is almost completely free from augmentative action by other muscles which might produce electrical interference. In fact, when the triceps is contracted, the flexor antagonists are relaxed and produce no motor unit activity.

The isometric, rather than the isotonic, contraction of the triceps was the function chosen to be measured, for many reasons. If a muscle is allowed to contract isotonically, it can be made to do work in lifting a weight. This work can be measured by multiplying the weight by the distance through which it is moved ($W = F \times D$). However, this is not a satisfactory method, for the following reasons: As the weight is lifted, the tension of the muscle decreases steadily in a nonlinear pattern. Also, at the start of the contraction the muscle is pulling against a stationary load, so that inertia has to be overcome; whereas, at the end of the motion, the weight is moving and will have momentum, even enough to carry it beyond the point to which the muscle is able to contract. The conditions are therefore not the same throughout the period of work, and measurements are therefore only approximate.

On the other hand, when the ends of a muscle are fixed, as in isometric contraction, the muscle passes into a state of steady tension, and its energy does not appear as work in the sense just described, but appears as heat, which can be accurately measured. It is possible, however, to calculate the work done by the muscle, not by the weight lifted but by the amount of tension developed as the muscle shortens through a small distance, as postulated by Hogben.[11] Suppose that the muscle is initially relaxed and that T_1, T_2, T_3, etc., are the tensions developed when the muscle has been allowed to shorten by small steps, $\triangle L$. Tension is measured in the same units as force (Grams per centimeter), and L is a distance such that the work done when the muscle contracts through the first little step is $T_1 \triangle L$; that done as it shortens through the next little step is $T_2 \triangle L$, and so on. If the muscle shortens from its initial length, E, associated with tension T_1 to some other length, C, associated with a small tension T_9, the work done in the development of this whole contraction will be: $W = T_1 \triangle L + T_2 \triangle L + T_3 \triangle L + T_4 \triangle L^* \ldots\ldots T_9 \triangle L$, or, when

$\triangle L$ is infinitely small, $W = \int_c^E T.dL$. Here C is the length of the muscle when fully contracted and E its length when at rest. To find the value of W in any particular case one must first find how T varies with L. Ponder[12] described an experiment in which one end of a muscle is clamped firmly in a holder which can be screwed up or down so as to stretch or relax the muscle. The other end of the muscle is attached to a strong spring which can be slightly deformed by the muscle without the muscle shortening to any appreciable extent. The deformation of the spring measures the tension developed in the muscle, and is rendered visible either by the attachment of a long lever moving along a finely divided scale or by the employment of an "optical lever." The measurements are begun when the muscle is held at its normal length, neither slack nor extended. A stimulus is given and the tension developed is recorded. The muscle is then put on the slack by turning the screw which moves the clamp so that the clamp rises 1 mm. Again the muscle is stimulated and is able to contract 1 mm. The tension is again measured. The screw is then turned so that the muscle may contract 2 mm. with the next stimulation, and the tension developed is recorded. This process is continued until the muscle is so slack that it exerts no tension at all on the spring when it contracts. The total distance through which the clamp has been raised now represents the distance through which the muscle would contract in a full single contraction. This procedure gives a series of measured values of T and L, so that the one can be plotted against the other in a curve. The area under this curve represents the work done by the muscle during its contraction and depends, of course, on the size of the muscle studied. Hill[13] has demonstrated that the work done during contraction, as measured by this area, varies with the length of the fiber and with the tension, T, which it can exert in a contraction which does not result in any shortening, in such a way that $W = T.L/6$, where L is the length of the fiber. Thus, if the muscle was 3 cm. long, and the tension set up in a completely isometric contraction was 50 Gm., the work done by the muscle under these circumstances would be 25 Gm. per centimeter. Since $4.26/10^{-4}$ Gm. per centimeter of work is equivalent to 1 microcalorie of heat, the work done by the muscle in the example given, when measured in terms of heat, as work can be measured, would be $5.86\,(10^4)$ microcalories.

The exact measurement of the heat produced during contraction of muscle, as carried out by Hill, has shown that the actual heat produced by a muscle in isometric contraction is just what might be calculated from the relation $W = T.L/6$. It may be inferred from this that in the process of contraction the whole of the potential energy of the muscle is liberated as mechanical energy and that under ideal circumstances all this energy might be used to do work. This, of course, would be the case only if the muscle were not to shorten at all, for the $W = T.L/6$ formula applies to isometric contractions only.

Malmo and associates[14] have shown that muscle potentials from surface electrodes increase in amplitude as the work required of the muscle is increased, and that the amplitude of the potential from muscle is closely related to the strength of the muscular contraction or degree of muscular tension. As tension increases to ranges from 18 to 20 Kg., curves become increasingly exponential; in ranges below 6 Kg. they are linear.

A standard two channel electromyograph was chosen for measuring the amplitude of the muscle potentials in this experiment. The surface electrode was chosen for a number of reasons. Davis[15] has stated that in measuring muscle potentials one must consider the muscle as a source of electrical activity surrounded by a conducting medium of low resistance called a volume conductor (interstitial fluid

or blood). This in turn is surrounded by skin, which is a two layer membrane consisting of a metabolizing layer of living cells, glands and accessories having a relatively low electrical resistance and a nonmetabolizing layer of horny, dead and dying cells which has a high electrical resistance.

The problem of instrumentation, then, is to get at and measure the electrical activity of muscle with as little interference from other factors as possible. In the present study, in which only amplitude was to be measured, there was no necessity for the use of coaxial intramuscular electrodes, which in and of themselves produce artefacts due to pick-up (antenna) activity and also secondarily due to the pain and emotional stress involved in their use. Because of its ability to pick up action potentials from many muscle fibers, the surface electrode is particularly valuable for studying muscle tension, since in this field it is the whole muscle, rather than a microscopic part of it, that is significant. When many muscle fibers fire asynchronously and repeatedly, many of their after-potentials tend to cancel each other out, whereas the spikes occur so rapidly that relatively few of them cancel out and the pattern becomes coarser and of higher amplitude as the muscle increases its activity. This simplifies the observation and measurement of the peak value on the oscilloscope screen and on the tracings. Lindsley[16] has said that surface leads are best for studying muscle tension associated with emotional reactions. Fatigue certainly involves emotional as well as physical changes. In studying amplitude variations, one does not have to concern oneself with the observation of the complete waveform seen on the screen. One need only observe the so-called envelope of the pattern, that is, the configuration of the peaks of the spikes seen. If one pretends that the peaks are connected like points on a graph, one sees the envelope.

There are many different factors which interact to modify the muscle potential as visualized on the electromyographic screen: (*a*) type of muscle being studied (smooth or striated); (*b*) use of the muscle (for postural control or the like); (*c*) size of the muscle (atrophic, hypertrophic or normal); (*d*) sex (only male subjects were used in this experiment); (*e*) degree of individual development; (*f*) number of motor units per axon, and (*g*) oxygenation, metabolism and blood flow.

Procedure

The following procedure was carried out on 285 subjects, to determine the effect, if any, on muscle tissue when rubefacients were applied to the skin over the muscles after they had been fatigued:

The patient was seated at a table in front of which was a mechanical device so arranged that the motion of extension of the triceps lifted a heavy weight over a distance so short that it inhibited isotonic contraction and produced an isometric contraction instead. A weight was chosen for each patient which would cause his muscle to become fatigued in approximately two minutes. This weight varied with each subject according to his body habitus, and had to be determined before the test could be done. After the first dozen or so tests, it was simple to estimate roughly how much weight would be required. After the fatiguing weight was established, at another sitting, the patient was fitted with silver surface electrodes, 1 cm. in diameter, and the testing was begun. Placement of electrodes was standardized as follows: A point half the distance from the posterior axillary fold to the lateral epicondyle of the humerus was used for the active electrode. The reference electrode was placed 2 inches (5 cm.) distally on the same line. These electrodes were then attached to one channel of the electromyograph. As the triceps contracted isometrically for two minutes, the amplitude and the shape of the envelope were observed and recorded on magnetic tape. After the two minute fatigue period, the patient was given a minute rest period, after which he again performed the isometric contraction until fatigue set in again. The time required to produce fatigue was measured by stopwatch, and after another one minute rest the procedure was repeated, with one minute rest, contraction to fatigue, rest and contraction to fatigue and so on. The point of fatigue was determined by three parameters. One was the period until the weight could no longer be supported. The second was the obvious decrement in amplitude of the action potentials. (It was noted that just before fatigue set in there were wild bursts of action potentials, which then fell away rapidly.) The third was the marked

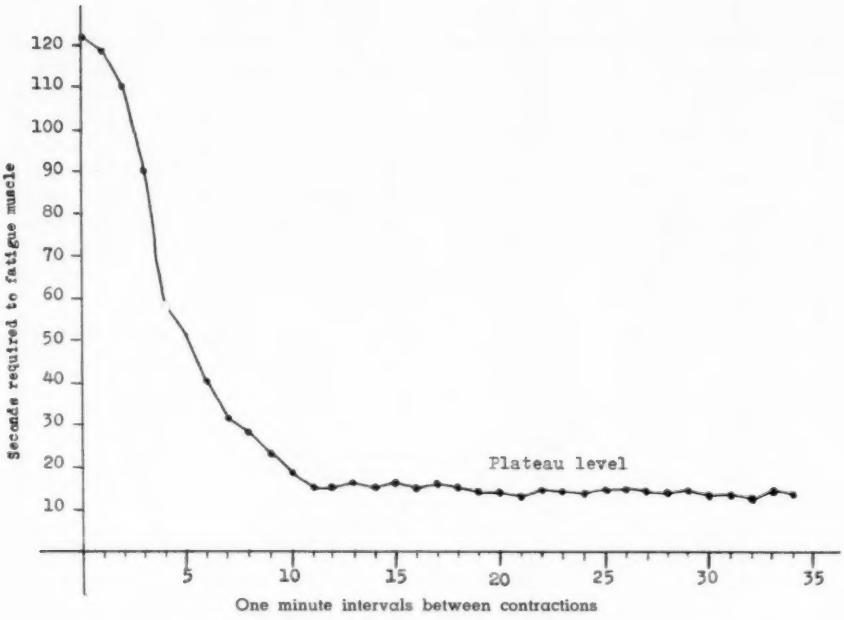

Fig. 1 — Chart showing average results for a series of subjects without medication.

decrement in audible sound which was evident as a result of the fall-off in action voltage. Direct readings in decibels were taken with a commercial sound level indicator which consists of a nondirectional microphone, an electronic amplifier and an indicating meter. The instrument had built-in weighting circuits which allowed for correction of the level of ambient background noise.

Results

After about ten minutes of testing, the fatigue point reached a plateau on the graph, and beyond this there was little variation in time readings, which remained between fifteen and eighteen seconds. Average results for a series of muscles are shown in figure 1. It should be clearly understood that each of the subjects was doing a different amount of work, because of the difference in weight supported. However, this was precalculated so as to bring all the results within a reasonable range and allow practical graphs to be plotted for comparisons. Furthermore, each man was his own control in the whole series, and his results were compared with his own previous performance under conditions identical except for the medication.

After this pattern was well established, some members of the group were tested again, with the following change in method: After the plateau of fatigue was reached and had been maintained for ten fatiguing periods, the triceps was sprayed with a rubefacient from an aerosol can, in order to avoid massage. In each case it was evident that after a period which varied from six to ten minutes, the time required to produce fatigue began to increase again, up to periods of fifty-four seconds. This was more than double the time required to produce fatigue before the application of the rubefacient (fig. 2). Other members of the group were reexamined, with this change in method: The rubefacient was sprayed on fifteen minutes before the test was started. The results in each case showed the following changes: 1. It took longer than the two minutes previously required to produce the first fatigue level. 2. The decrement time was much longer than it had been at

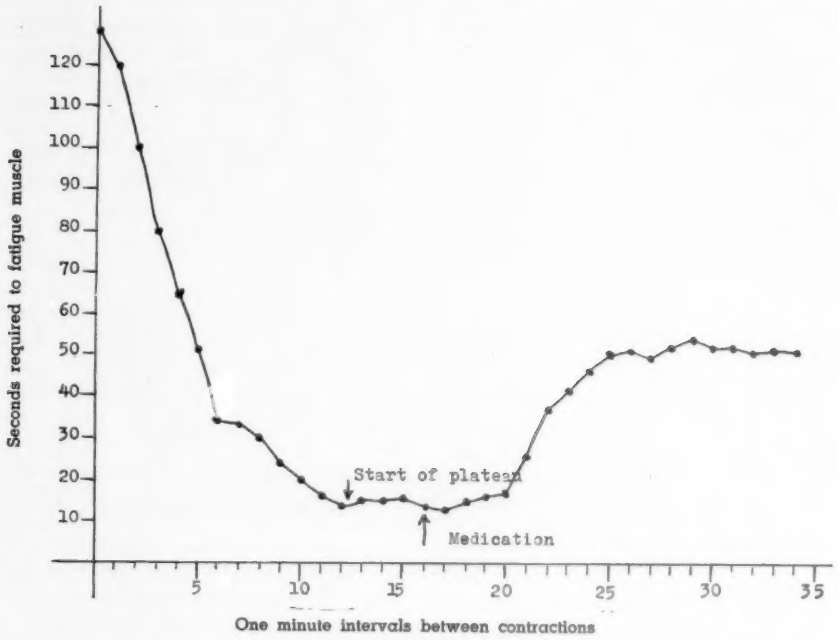

Fig. 2 — Chart showing average results for some of the subjects in figure 1 after medication.

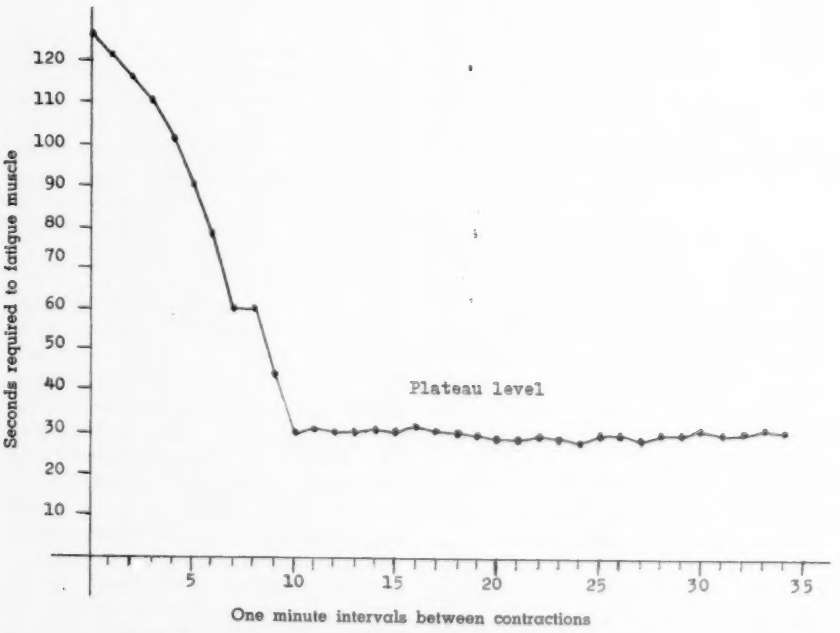

Fig. 3 — Chart showing average results for some of the subjects in figure 1 when medicine was applied fifteen minutes before test.

the original examination. 3. The plateau level was elevated by approximately fifteen seconds (fig. 3).

Members of the group were later tested again in the manner first described, and after each had reached the fatigue plateau, he was sprayed with water from an aerosol can. Now the time required to produce fatigue remained the same and in some cases (fig. 4) lessened.

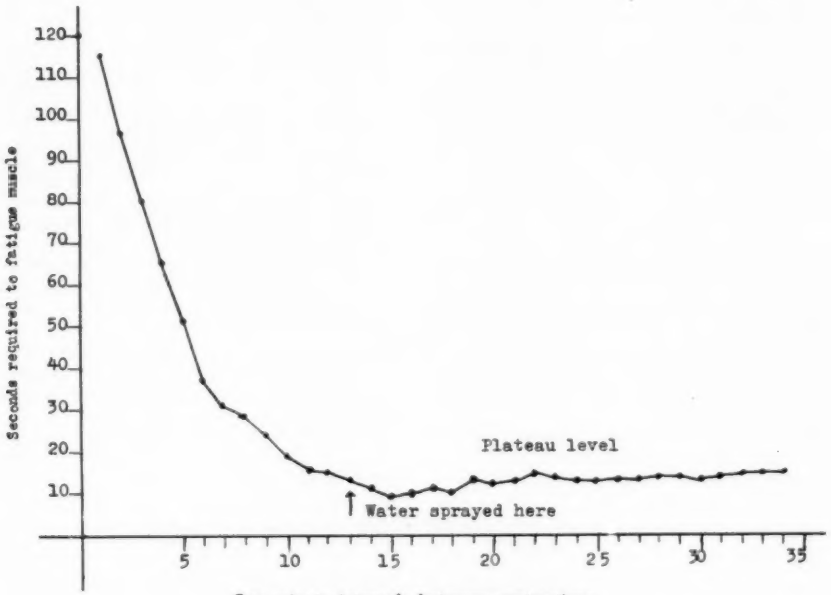

Fig. 4 — Chart showing average results when some of the subjects previously tested were sprayed with water instead of rubefacient.

These results imply that there is a definite absorption of the rubefacient through the skin and that because of the action of the preparation there is an increase in the flow of blood to the muscles, with the concomitant waste disposal and other chemical changes in the muscle which produce recovery. It is worthy of note that the rubefacient used in this experiment had an acetone base, which, by evaporation, first caused cooling of the skin and then produced heat. This may have a reflex effect on the vascularity of muscle by producing changes in the thermal gradient extending from the skin to the deeper structures. In this case the first reflex response would probably be one of peripheral vasoconstriction by the body in an effort to prevent loss of heat by conduction.

Conclusions

1. Percutaneous absorption does take place.

2. Rubefacients applied to the skin do have a definite effect on muscle tissues, namely, that they increase the time required to fatigue a working muscle. This has been demonstrated by comparing reactions of a given muscle to the same amount of work under the same physical conditions with and without medication.

3. A muscle increases its capacity for work while in action shortly after a rubefacient is applied to the skin over its surface.

4. The electromyograph is an excellent laboratory instrument for testing the effects of drugs on muscle tissue.

The rubefacient was supplied by W. F. Young Mfg., Springfield, Mass.

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For the want of a nail the shoe was lost; the horse was lost; the rider was lost and the purpose was lost.

—ANONYMOUS

Motivation for Recovery: Four Social-Psychologic Aspects

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● Four psychologic factors are discussed as hypothetic aspects of patients' motivation for recovery during physical rehabilitation. These are the realism and clarity of their goal-striving aspirations; their acceptance of suitable value-standards and behavior patterns; their demonstration of adequate tolerance for frustration producing experiences, and their increasing degree of autonomy, as suggested by the development of more equalitarian feelings toward the hospital staff. A theoretic attempt is made to consider how motivation for recovery might be related to the operations of hospitals as social systems, in the light of research on hospitals and other institutions.

Effective treatment of many catastrophic or refractory illnesses may require extended periods of supervised institutional care. This the modern hospital stands ready to provide with its complex facilities and staff of experts in the biologic and social sciences. Unfortunately, facilities and staff alone are insufficient to guarantee recovery. Some patients, of course, suffer from maladies beyond the scope of present medical science, but others fall by the wayside for reasons that cannot be clearly identified as organic in nature. A number fail to respond favorably during hospitalization, despite every effort in their behalf.[1] Others are active rehabilitation participants while they are in the hospital, but after discharge somehow do not follow through.[2] A set of crucial psychologic unknowns surrounds the circumstances which govern patients' tendencies to make constructive use of the experiences and services available to them in the hospital. If the success of rehabilitation for the patient and the efficacy of the hospital as a therapeutic instrument are influenced by such factors, then specific investigations should be made to determine the conditions which promote or interfere with favorable response to treatment.

Rehabilitation personnel long have distinguished two aspects of this problem. The first of these is the evaluation of "rehabilitation potential," i.e., the development of rational and reliable measures for differentiating between individuals who may be considered "good risks" for certain kinds of treatment and those whose prospects seem less hopeful. The second is the inculcation of attitudinal and behavioral patterns in patients that will increase their amenability to rehabilitation procedures, i.e. the cultivation of "motivation for recovery." Both issues have been researched from the viewpoint of what might be termed traditional clinical personality theory, in which attempts are made to interpret evidence of allegedly undesirable patient behavior, in physical treatment settings and elsewhere, in the light of psychopathologic categories.[3,4] Seeming lack of individual motivation tends to be seen as symptomatic of psychologic illness to be treated by behavioral methods, as physical infirmity is treated by medical technics, in the context of a distinctive relationship between the ill person and a superordinate specialist in healing.[5,6]

Among the reasons for the persisting popularity of a pathology-centered approach may be the fact that it derives from a widely reinforced conception of healing common not only to fields of medicine, but also to those of the behavioral disciplines that take the classic two-person, doctor-patient transaction as their model for the giving of help — namely, psychologic therapy, social casework, and the broad areas of vocational counseling and guidance. However, evidence has been uncovered which seems to call for reassessment of an approach through pathology to the study of motivating patients to receive and utilize rehabilitation programs, and, by contrast, suggests an alternative social-psychologic conception. Some of the features that such an approach might

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include will be outlined in the present discussion.

The beginnings of a different orientation were signaled by Henderson's paper of the mid-1930's. The author, a medically trained biologic scientist, visualized the doctor-patient interaction as a social system moving toward equilibrium, analogous in its operations to physicochemical systems.[7] In this entirely speculative discussion, Henderson eschewed traditional clinical categories; he suggested that the determining forces within this social system arose primarily from the feelings and expectations of the participants concerning their respective roles in treatment and the meaning of illness for both patient and physician. Henderson's effort drew particular attention to non-rational but potent forces in the therapeutic relationship in medicine, and embedded them in a distinctively different conceptual model.

At about the same time Dembo and Hanfmann reported on the attitudes and behavior of mental patients newly admitted into a hospital.[8] Within the Lewinian "field-theoretical" framework they pointed out at least six differentiable reaction patterns in a group of about 100 patients subjected to careful interviews and observation. These patterns apparently reflected consistent differences in social conduct, reactions to illness, perceptions of the hospital and staff and response to the demands of institutional living, and seemed to cut across the boundaries of conventional psycho-pathologic diagnostic categories. Like Henderson's essay, Dembo and Hanfmann's work suggested the merits of an approach to behavior analysis of hospital patients independent of conventional clinical interpretations. Late in the 1930's Rowland inaugurated one of the earliest sociologic researches on the mental hospital as a miniature community.[9] Research on the therapeutic implications of hospital or ward social organization has since greatly accelerated, with growing attention to power structure, role and status differentiation, informal social networks, communicative problems and the effects of social and geographic isolation on staff and patients. In general, research on hospitals has increasingly been related to studies of behavior in other organizational frameworks.

For example, Caudill and his associates in a now-classic investigation of the social structure of one of the wards in a psychiatric hospital, indicated that many features in the behavior of ward occupants were shared by residents in orphanages, displaced persons camps, tuberculosis sanitoriums, prisons and other institutional settings where overt emotional disturbance was not a major reason for incarceration.[10] The main argument of the Caudill paper seemed to be that the social conditions of mental hospital life as experienced by the patients, rather than their individual emotional pathology as such, were the major determinants of the ways that they actually behaved. While Caudill and his colleagues did not specifically trace out the ramified impact of these social patterns on response to treatment, other investigators have subsequently undertaken to demonstrate such relationships.[4,11,12]

The pertinence of studies on hospital organization to the concept of recovery motivation was suggested by a need for explanatory hypotheses in a recently completed pilot investigation. The major objective of this research was to learn if psychologic indices could be defined which would discriminate between well motivated, physically disabled patients and poorly motivated individuals. Impressions from this study suggested four hypothetic measures:

a. The realism and clarity of their goal-striving aspirations.

b. Their acceptance of suitable value-standards and behavior patterns.

c. Their demonstration of adequate tolerance for frustration-producing experiences.

d. Their increasing degree of autonomy, as suggested by the development of more equalitarian feelings toward the hospital staff.

The balance of this paper is an attempt to specify some of the possible ways in which the functioning of the hospital as a social system may influence these conjectural aspects of motivation for recovery.

Aspects of Recovery Motivation

A. Realism and clarity of goal-striving aspirations. In its goal-striving aspect, motivation for recovery may include three antecedents. First, it is required that the patient become able to clearly frame the rehabilitation goals to be emphasized, and the steps that must be taken to achieve them; second, that he establish a stable perspective toward goal-striving activities within which the ordering of goals in priority reflects both their judged importance and their relative accessibility in terms of medical and psychosocial realities; and third, that he invest the amount of effort required to carry out these aims. Other things being equal, it would seem reasonable to expect that patients who most nearly satisfy these preconditions should be ablest in mobilizing themselves for effective participation in the rehabilitation process and consequently should make the best use of hospital facilities and services.

To a considerable degree, success in arriving at feasible, unambiguous rehabilitation objectives seems to depend upon the establishment of free and mutually available communication channels between staff and patients. The patient entering upon prolonged or intensive treatment is likely to have many confused wishes, expectations and fears about treatment and disability. The potentially negative repercussions that disablement may have upon the pre-morbid way of life and especially upon social status and acceptability, warrant particular attention.[5,6,12,13] Formulation of a concrete series of practical recovery goals seems to be contingent upon the staff's ability to understand the forces at work in the patient's psychologic situation and, perhaps most importantly during the early stages of treatment, their ability to translate this knowledge into a series of graduated recommendations and activities which make sense to the patient, attract his efforts and afford him tangible bases for experiencing and coping with rehabilitative change.[14] Thus, factors which obstruct or distort the flow of this kind of communication may interfere with accomplishment of these purposes.

One feature of hospital social organization that has received extensive discussion in this context is its frequent structuring along autocratic caste lines; some have felt that such stratification may act to isolate patients from staff, and professional from nonprofessional staff. In one early investigation, Rowland showed that the rigid hierarchic social structure of one mental institution generated barriers which blocked communication between patients and staff, with possibly negative effects on treatment.[9] More recently, Jones has claimed that therapeutic effectiveness of staff-patient contacts in a psychiatric institution has been generally augmented by consciously decreasing the social gulf between these strata of the hospital community.[15] Jones' position has gathered strength from a growing research literature on attitude change, particularly in connection with treatment. It appears that reduction of perceived disparities in status, by promotion of a sense of community or shared perspective, may heighten the patient's susceptibility to influence through communication from a therapist or staff member.[4,16]

The belief that improved patient reactions should follow upon perceived increase in "seeing things the same way" as the staff is not of recent origin, although perhaps it has been most elaborately exploited only within the past decade. Research has not been decisive in this area, although some psychotherapeutic instances are reported where lack of congruent expectations between client and therapist seemed to be related to poor response in treatment.[12]

Less is known about differences in response to treatment when the patients

are physically rather than emotionally impaired. In one study dealing with a near-geriatric population in a chronic disease hospital, Shontz and Fink reported that patients involved in relatively more intense treatment relationships tended to establish better "communicative rapport" with their therapists, as measured by the Osgood Semantic Differential. The change in communicative rapport was viewed as movement on the patients' part in the direction of an idealized "model" of the therapist as a person; however, no data were offered to show conclusively that differences in communicative rapport were related to comparable differences in response to physical treatment.[16]

This logic may partially apply to intrastaff communication barriers, although obstacles to free interchange among the staff are probably in the main occasioned by somewhat different facets of the hospital's social organization. Among the staff, complications may be intensified by the caste system but arise fundamentally from differences in professional training, and particularly from differences in prestige and in decision-making authority, insofar as these latter are not felt to be commensurate with the realities of day-to-day responsibility for direct service to patients.[11,12] Feelings of alienation, mistrust, exploitation and indifference have been voiced with notable frequency, especially on the part of semi-professional or non-professional personnel. This may be significant in the light of some evidence that intrastaff misperceptions or communicative breakdowns can have undesirable consequences for patient behavior.[12] However, this finding is not beyond dispute, and in any case it is not known whether these effects are transitory or enduring, or whether they influence patients selectively in terms of the strength of their ties with particular members of the staff.

Such results do not establish that removing sources of communicative interference between members of the hospital community will insure agreement regarding desirable and accessible rehabilitation goals. However, they strongly imply that failure to overcome these deficiencies is likely to prevent optimal concordance from being reached, and in this sense may interfere with the development of appropriate recovery motivation in patients.

B. Acceptance of suitable value-standards and action norms. Some years ago, Dembo and her associates studied psychologic problems encountered by disabled veterans who were attempting to work out a *modus vivendi* in relation to non-disabled people.[13] They found that healthy patterns of adjustment involved a change in the values of the disabled person. In the course of this transformation, the impaired individual surrendered his allegiance to common standards of physical normalcy by which he would be judged unworthy and defective, in favor of a different orientation in which areas of positive achievement for the physically altered self were stressed. Dembo's study left open the question as to which particular configuration of values the disabled person should adopt. However in research in mental hospitals, prisons and other settings where a primary function of incarceration is to bring about behavior modification in a captive group, it seems to be implicitly assumed that the value-system identified with the professional staff should serve as a reference point.[5,11] It is not improbable that workers in rehabilitation hospitals also subscribe generally to this position.

It is not difficult to understand why patients who conform to staff expectations may be more favorably perceived and awarded credit for "trying," whereas patients who do not conform in this regard are often seen as persons who do not wish to get well. Nonetheless, this widespread assumption is not necessarily the only plausible account of nonconforming patient behavior.

Barker et al. indicate that, in the United States, a high cultural value

is attached to unblemished physical appearance and functioning; those who depart appreciably from this unwritten norm may face devaluating exclusion from or restriction of access to desirable activities and affiliations.[3] Parsons observes that severe illness may be viewed as a form of social deviance which challenges cultural standards predicated upon physical normalcy and self-reliance.[6] In its communal responsibility, then, the hospital becomes an instrument for alleviating the symptoms of physical pathology, and thus a means for reducing the outward signs of deviance as well.

The goal of striving toward physical normalcy is in one sense both a moral and a medical commitment between patient, institution and society. To achieve these aims hospital and community grant the sick individual leave of absence from his accustomed place in the social fabric. In turn, it is commonly expected that the ill person will demonstrate his unqualified readiness to sustain the negative psychosocial features of confessing his inadequacies, accepting illness and enduring, without major complaints, its concurrent and supposedly transitional career of patienthood.[6] Well-accultured persons, whatever their objective medical needs, may find that taking this step involves many unclear, unwelcome and possibly anxiety-provoking elements which it is only natural that they try to avoid or minimize. Equally naturally, if the hospital staff have a powerful emotional investment in what they perceive to be the hospital's generally understood curative or ameliorative obligation, it is conceivable that this resistive conduct may be interpreted as wilful opposition, intransigence or indifference to major social values, as compared with the reactions of similarly disabled individuals who are not seen as troublesome or unmotivated. However, appearances notwithstanding, this may not be a simple relationship. In a study of paraplegics undergoing physical rehabilitation, Goldsmith found no appreciable differences in favorableness of reaction to treatment between "good", undemanding patients and those who disclosed a degree of self-assertiveness more commonly found in the world outside the hospital.[17]

The prevailing standards for "good" patients, and the steps by which the "good patient" role is acquired, appear to involve a process of resocialization which may be distinctive of different forms of hospital organization.[11] Hospitals are not necessarily uniform in this respect. Students of "total institutions" such as Goffman have observed that when a group of persons is radically segregated from their environing society, as has often been true of long-term mental or chronic disease patients in large public institutions, a unique social microcosm tends to spring up within the confining walls. The sick person admitted into the "total institution" usually encounters a psychologically unfamiliar situation in which attempts are made to coerce him into surrendering cherished prerogatives and areas of autonomy without receiving in exchange other forms of positive recognition or gratification. The act of institutionalization is itself often experienced as a symbol of social devaluation and ostracism. Highly formalized subordinating relationships with staff, and "stripping operations" which divest the individual of his extramural status and privileges, underline this judgment.[11] Loss of support from security-conferring ties and environments seems to intensify feelings of uncertainty and rejection. Given these psychosocial conditions, it is common for subcultures to develop among the patients in which an ego-defensive or self-protecting theme is pronounced. The neophyte patient is systematically exposed to indoctrination during which he learns that security and status are to be found only among his fellows, and considerable informal pressure may be exerted upon him to give minimal or surface compliance to institutional authorities and maximal effort to maintaining group solidarity with his peers. Failure to fit in with this pattern, as when too much zeal is displayed in following staff

recommendations or individualized attention is sought from the staff, may lead to isolation from the peer culture or to even more drastic forms of reprisal.[5,11]

To the extent that admission into a hospital bears the connotation of personal misfortune and prospective status loss, it cannot be surprising that forces should arise within the institutional milieu which render patients less accessible to influence by staff in the area of value change. The formation of encapsulated, seemingly change-resistant subcultures may represent one of the few recourses available to long-term patients for protecting themselves against social devaluation while preserving a semblance of normal social relationships.

However, a quite different adjustmental pattern may emerge if a tightly knit patient subculture fails to develop. Prior research is not wholly clear upon this point, but impressionistically, one might speculate that the latter alternative is probably closer to the facts of life in more contemporary general or short-term hospitals where social, emotional and economic bonds with the outer world may become attenuated for brief periods but are rarely severed. In this case psychologically protective interactions among the patients appear to be less common and less crucial as behavior determinants and more consistent pressures may arise in the direction of conformity to staff expectations for "good patients," which Parsons has conceptualized as the "sick role."[6] One psychosocial danger in sick role adaptation is that if it becomes too firmly established the patient may become a "hospital cure" and unfit for life outside the institution; as the time of discharge approaches, such individuals may sometimes embark upon ludicrous or desperate measures to avoid being cast out of their "home away from home."[11] Attempts to secure recovery motivation must accordingly steer a hazardous course between the Scylla of resistance, uncooperativeness or indifference, and the Charybdis of overcompliance, lack of self-determination and a manipulative use of illness by the patient.

In overview, getting patients to adopt values and behaviors promulgated by the staff seems to call for at least three intermediate steps. First, the patient must recognize that he needs help in order to achieve a prized goal; second, staff members must be identified as persons best able to provide the needed help; and third, acceptance of help and its attendant changes of attitude and conduct must be seen as free of important conflict with other valued aspirations or affiliations.[5,11] For the most part, investigators have concentrated on studying the forces that may prevent patients from conforming to staff-centered prescriptions. Relatively few questions have been raised concerning the alleged desirability or appropriateness of these standards themselves, although writers like Meyerson[18] have indicated that staff members may perpetuate rather than alleviate the disadvantaged status of the patient if they espouse unrealistic or unsuitable values.

One therefore must proceed cautiously in using acceptance of staff standards as a generalized criterion of high patient motivation for recovery. It is first necessary to know under what conditions conformity to staff expectations really serves the interests of patient progress as the patient might evaluate his goals, and when it represents a device for maintaining the internal security of the institution's social order for other persons in his situation. Clearly, it should not be left to chance for these aims to harmonize in an institution dedicated to the giving of help, although a comprehensive solution to this problem cannot be recommended at present.

C. Demonstration of adequate frustration tolerance. This aspect of motivation for recovery has not been thoroughly explored, although it was recognized some time ago.[3] When well and poorly motivated patients seemed to reveal differences in frustration tolerance in the pilot study, two areas of behavior were especially significant.

Well-motivated patients appeared better able to tolerate the discomforts, deprivations and restrictions of hospital life with greater emotional equanimity, and were also better able to foresee and admit to specific medical and psychosocial problems in recovery without feeling overwhelmed or apathetic. Janis[4] has reported similar findings among ex-surgical patients.

While it has been customary to think of frustration tolerance in psychodynamic or personality-theoretic terms, some studies have shown relationships between ability to withstand and anticipate the stresses of hospitalization and social-psychologic factors. Zborowski investigated groups of patients of differing ethnic composition in a large East Coast hospital and found striking associations between individual patients' technics for handling pain and their perceptions of how their subgroups expected them to act. Jewish and Italian patients, for example, gave free expression to physical discomfort or loneliness whereas "Old American" patients tended to conceal feelings of distress.[19] Lidz has pointed out in a similar vein that many patients are concerned about their ability to "take it" in the eyes of hospital staff.[20] It would appear that standards for appropriate behavior in coping with the stressful concomitants of hospitalization are in part determined by the perceived values of "significant others" in the patient's situation. However, research is comparatively slight on the concrete ways in which social conditions in the hospital might affect individual frustration tolerance.

If lack of clarity about goals or problem-solving procedures might contribute to ineffective response under stress, one positive effort in building frustration tolerance would be to create avenues for adequate communication between patients and staff, in the perspective of a philosophy of treatment planning that involves specific steps toward goals of varying remoteness during which the patient may visibly discern his progress.[3,14] A second measure would involve strengthening the patient's psychologic support for dealing with anticipated stressful experiences during institutional residence. Reassurance of personal worth and offers of assistance should be provided without robbing the individual of opportunities for autonomy or overemphasizing his limitations.[13] This necessitates intensive study of appropriate relationships among and between patients and staff during different phases of the rehabilitation process. Under ideal conditions this support should represent the concerted enterprise of both staff and fellow-patients on behalf of the rehabilitee. How this would be accomplished remains as yet to be worked out.

Finally, additional consideration might be devoted to the role of regressive behavior in recovery. Regressive behavior is often regarded as indicative of unfavorable or undesirable response to treatment and at times this may be true. On the other hand, Dembo and her co-workers found that during the early post-traumatic period, the primitiveness of conduct and emotional lability entailed in "mourning one's loss" could in fact be an important adaptive stage during which the sick person prepared himself for organized, affirmative action.[13] Janis has reached similar conclusions in his conception of "the work of mourning."[4] Indeed, the studies of Dembo and Janis suggest that it may be highly profitable to study the social conditions under which it could be helpful to permit or even to direct and facilitate the manifestations of regressive conduct as an aid to recovery. Unfortunately, the determinants responsible for concluding the mourning period and diminishing the subsequent use of regressive behavior are still incompletely understood.

D. Development of more equalitarian feelings toward the hospital staff. With comparatively few dissents, it seems to be generally expected that relationships between patients and staff and among staff members themselves will fairly well mirror their differing formal

status in the social system of the hospital. This may establish a pattern of passivity or subordination that is reinforced by other components of the treatment situation. For one thing, contacts with the staff are, in the case of a severely ill person, indispensable; they are the *sine qua non* for hospital residence. The patient often finds himself in a materially dependent, emotionally vulnerable condition in which physicians and other influential figures are perceived as quasi-parental personages who are able to control many of the contingencies determining approval or disapproval of behavior, and also enjoy the authority to make unilateral decisions concerning the patient's physical mobility or the disposition of his body.[4,6]

Thus, it would not have been surprising to learn, in the pilot study, that patients' perceptions agreed with this ordering. However, it appeared in fact that better-motivated patients showed appreciably greater disposition to equally value medical and non-medical role groups in the hospital, and they also perceived smaller discrepancies in relative valuation among all of the groups.* It seemed plausible to wonder if observed differences between high and low motivated patients might not be related to a lowered level of dependency need in the higher motivated subjects. One hypothesis could be that the movement toward greater self-determination might be shown by a diminished tendency to perceive the importance of various groups in terms of their formal status ranks in the institution, and a correlative rise in disposition to make valuations on the basis of direct personal experience with their members. Unfortunately there seems to be no pertinent research against which this hypothesis might be tested.

Insofar as these may be related to the patient's growth toward independence and away from over-reliance upon sanctioned authority, changing perceptions of various role groups encountered in the hospital may signify increased motivation for recovery from the patient's viewpoint. However, if the accompanying attitudinal or behavioral alterations are seen to challenge preexisting staff expectations for patient behavior toward power figures, a quite different interpretation of the sick person's motivation may be construed by some staff persons, whatever the medical facts of the case may be, as Goldsmith's study suggests.[17]

*The medical role groups were doctors; nurses; therapists, and orderlies. The non-medical role groups were other patients; social workers; psychologists, and people outside the hospital.

Discussion

It would seem, therefore, that motivation for recovery cannot be reduced to a unitary personal attribute which the patient should possess if he is to make optimal response in therapy. Nor should absence of adequate motivation be regarded as a simple index of individual recalcitrance or maladjustment. Rather, motivation for recovery seems to represent the outcome of a complex pattern of values and relationships which must be shared in mutual respect by staff and patients if rehabilitative practice is to attain its hoped-for constructiveness. To this extent, both the measurement and the creation of recovery motivation necessarily reflect the social conditions of hospital functioning in their impact upon both staff and patients of which explicit treatment relationships are perhaps only the most evident feature.

Summary and Conclusions

Four psychologic factors are discussed as hypothetic aspects of patients' motivation for recovery during physical rehabilitation. These are:

A. The realism and clarity of their goal-striving aspirations.

B. Their acceptance of suitable value-standards and behavior patterns.

C. Their demonstration of adequate tolerance for frustration-producing experiences.

D. Their increasing degree of autonomy, as suggested by the development

ot more equalitarian feelings toward the hospital staff.

A theoretic attempt is made to consider how motivation for recovery might be related to the operations of hospitals as social systems, in the light of research on hospitals and other institutions.

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Information relative to securing reprints of this study may be had by checking the Reader Service column on page iv of this issue.

True generosity consists not so much in giving a lot as in giving at the right time; in giving when it is most helpful to the recipient, not most agreeable to the donor.

—SYDNEY J. HARRIS

Pathologic Disorders of the Hip and Shoulder Joints: Observations of Cadavers with Notes on the Pathogenesis of Osteoarthritis

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● With respect to the hip joint, osteoarthritis is certainly the most common pathologic disorder in the older age group. Ordinary wear probably is the principal etiologic factor. It is conjectured that thinning of the articular cartilages of the hip would result in some instability at first; a chain of pathologic processes is then set in motion which, in time, comes to limit motion. In other cases the parts may be reciprocally worn down into a conical shape; in such a case hip motion, particularly abduction, would be limited from the first. Chronic rupture of the supraspinatus tendon and capsule of the shoulder joint is relatively common in the older age group, the instability of the shoulder joint due to this cause may eventually lead to recession of the greater tubercle or frank osteoarthritis; if these are present the degree is proportional to the amount of retraction of the tendon and capsule. The findings came from a study of hip joints of 68 cadavers and shoulder joints of 85 cadavers.

It has been the purpose of this study to determine the incidence and degree of osteoarthritis of the hip and shoulder joints in a series of cadavers and to search for evidences of etiologic factors that may be common to the disease in both locations.

The initial lesion in osteoarthritis, as stated by Harrison, Shajowicz and Trueta,[1] is a fibrillation of the articular cartilage, followed by a fibrous replacement of the non-calcified part of the cartilage and an increase in thickness of the calcified zone. These changes occur first, they point out and as observed by others, in the central or non-pressure area. Lapras,[2] who studied femoral heads removed surgically, also noted an initial superficial erosion of cartilage, then a deep erosion and finally an erosion of the bone. Landells[3] recently has shown that the bone cysts subjacent to the articular cartilage, which were once thought to precede, or at least develop simultaneously with, the changes in the cartilage, actually communicate with the joint cavity through internal incomplete fractures of the bone. The pressure on the synovial fluid is said to gradually weaken the cancellous bone which gives way before the hydrostatic pressure. The appearance of the cysts is, in some cases, coincident with the onset of the pain.

The capsular changes in osteoarthritis are quite marked. Lloyd-Roberts[4] noted a marked shortening of the capsule anteriorly and medially, and often inferiorly. This was attributed in part to the reaction of the tissues to joint detritus picked up by the synovial villi. The intense fibrosis was thought to contribute to the adduction deformity often present and, by producing traction on the nerve fibers with which the capsule is abundantly supplied, to be responsible for the pain. Characteristically, according to Hollander,[5] contractures, when they occur, result in a posture of flexion, adduction and external rotation. Haggart and Hammond[6] advise that persons with degenerative disease of the hip joint avoid flexion and adduction attitudes and deformities. This is a posture frequently assumed in sitting with the thighs crossed.

DeLorimier[7] and others have described a calcareous para-arthritis involving the tendons of insertion of the piriformis, obturator internus and gluteus medius muscles. The clinical manifestation is pain on abducting and rotating the thigh. It affects the age group of 43 to 50 years.

According to MacConaill,[8] it can be demonstrated on a mathematic basis that any disorders of ligaments preventing or limiting the conjunct rotation of the moving parts of a joint, and forcing too direct a path upon the

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moving bone, will lead to increased friction and to increased wear. Here is a suggestion, then, that contracture of ligaments, aside from any other basic pathology, can hasten the progression of osteoarthritis and may even contribute to its development.

The success of the intertrochanteric osteotomy, as recommended by McMurray,[9] for the treatment of certain suitable cases of unilateral osteoarthritis of the hip, is attributed, in part, by Walters,[10] to the medial displacement of the proximal fragment. This maneuver is said to carry laterally the rim of osteophytes about the femoral head, increasing motion thereby, and reducing the pain by preventing "impingement of osteophytes against the rim of the acetabulum". This type of operation also permits correction of external rotation and adduction deformities. As suggested by Lloyd-Roberts,[4] the upper end of the femur assumes a position in such cases which takes some of the traction off the shortened capsule.

What effect ordinary gait has upon the development of osteoarthritis is a matter of conjecture. Saunders, Inman and Eberhard[11] list several factors which contribute to a smooth gait. These include pelvic tilt and rotation, flexion at the tarsometatarsal joints, rotation at the ankle and flexion at the knee. In addition to these the presence of the tibio-femoral angle is said to be a modifying factor. When one of the joints of the lower limb is non-functional, particularly if it is the knee joint, energy requirements at the hip joint are increased.

In unilateral osteoarthritis of the hip joint there is often a history of trauma or of prior disease (which may be indirectly related to trauma). Osteoarthritis of the hip joint often complicates such pathology as congenital dislocation of the hip, congenital subluxation, coxa plana (osteochondritis of the capital epiphysis of the femur) and slipped upper femoral epiphysis. In these diseases, as shown by Ghormley,[12] the range of motion may be fairly normal but the pattern of motion is considerably altered, causing an abnormally increased pressure over a restricted area not normally subjected to such a degree of weight bearing stress. In unilateral cases there tends to be an early onset of osteoarthritis at about age 34. In bilateral cases the average age at onset is much later at about age 53.

The common lesions of the shoulder joint found in the cadaver have been well described by Horwitz,[13] who based his study on the findings in 75 cadavers. In some there was merely a thickening of the walls of the subdeltoid bursa with partial or complete obliteration of the bursal cavity. In 49 specimens the upper part of the musculo-tendinous cuff showed variable amounts of thinning, measuring in some instances only one to two millimeters. In 30 cases the superficial surface of the supraspinatus tendon was frayed and fibrillated with separation of the tendon fibers to form bands or straps. In many cases involvement of the subscapularis tendon was present; changes in the infraspinatus tendon were less marked and were usually absent in the teres minor tendon. Varying degrees of "chronic rupture of the supraspinatus tendon" were present. When the greater tuberosity was fully exposed there was evidence of bony recession and atrophy, the under surface of the acromion being also worn. Horwitz[13] observed in 75 of the specimens that the tendon of the long head of the biceps was constricted in its groove; in 30 there were varying degrees of flattening, thinning, fraying, fibrillation and even tearing, the latter being usually associated with bony changes about the tubercles. There were complete tears of the biceps tendon in four. In these the proximal end of the distal portion of the tendon was dislocated medially out of the groove and attached to the region of the lesser tubercle, the bicipital groove being shallow or obliterated. In 10 of the 150 shoulders examined (an incidence of 6.6 per cent) there was a complete

defect in the bursal floor, i.e., a complete tear of the supraspinatus tendon. The lesion was bilateral in three and unilateral in four. Six were on the right side and four on the left; in none of these was there any prior evidence of calcific bursitis, nor was there any history of injury. Frank osteoarthritis of the shoulder joint was occasionally encountered. These changes were attributed to excessive use and advanced age. He found no lesions of the tendons about the hip joint comparable to those in the region of the shoulder.

In 79 dissecting room specimens Grant[14] found that in no case was the shoulder capsule perforated in the 16 under 50 years, whereas in three of the 17 between 50 and 60 years, and in 16 of the 46 over 60 years of age the capsule was perforated on one or both sides. Moseley[15] suggests that one of the possible etiologic factors of lesions of the rotator cuff of the shoulder is a "chronic relative immobility", as for instance sitting for long periods hunched over desks and seldom putting the shoulder joint through a full range of motion.

Gofton[16] states that advanced forms of subacromial bursitis may result in extensive calcification of bursae and the classical "frozen shoulder" in which synovial structures about the glenohumeral joint are so shortened and adherent that virtually all movement in the glenoid cavity is prohibited. A new idea concerning the etiology of the "frozen shoulder" has been advanced by Thompson and Kopell,[17] namely that of an entrapment neuropathy resulting from compression of the suprascapular nerve in the scapular notch.

Materials and Methods

1. The hip joints of 68 cadavers from the dissection room were studied. The age distribution was 29 to 94 years; 52 of the 68 were over 60 years of age. In 44 of these, both hip joints were examined. In the remaining a single hip joint was examined. Drawings were made to show the distribution of the worn areas and rough estimates were made of the degree of wear. In the first 24 cases the abdominal aorta and in some cases the iliac and femoral arteries were examined for indications of atherosclerosis, and, if such were present, the degree was estimated.

2. Both shoulder joints of 85 cadavers were studied. Forty-three of these were male, 42 were female. It was particularly noted whether or not the capsule was intact, and drawings were made to indicate the extent of rupture of the supraspinatus tendon when present. It was also determined whether or not the tendon of the long head of the biceps was intact or possibly dislocated. The degree of osteoarthritis, if present, was recorded.

Findings

Hip joints (table 1). In four of the 68 cadavers examined a severe degree of osteoarthritis of the hip

Table 1: Degree of Osteoarthritis of the Hip Joint Graded+-++++, and of Atherosclerosis of Abdominal Aorta, Similarly Graded, Is Compared in a Group of Representative Cases: There Appears To Be No Correlation.

Case #	Age	Sex	Occupation	Osteoarthritis R.	Osteoarthritis L.	Atherosclerosis Abd. Aorta
4	78	F	Housewife	+	+	++++
15	84	M	—	+	+	++++
18	85	M	Carpenter	+	++	+++
21	81	M	Contractor	++++	+++	+++
22	73	F	Housewife	++++	++	—

Key to table 1: Osteoarthritis graded, as judged macroscopically: + fibrillation of articular cartilage; ++ localized areas of eburnation; +++ large defects in cartilage but localized; ++++ femoral head eburnated and deformed, i.e., flattened or otherwise altered in shape; corresponding changes involving acetabulum. Atherosclerosis graded, as judged macroscopically as follows; + isolated plaques; ++ numerous plaques but intervening intima normal; +++ extensive involvement but without thrombosis. ++++ extensive involvement with stenosing thrombosis.

joints was present (cases 21, 22, 38 and 40). In two of these (21 and 38, the former unilateral and the latter bilateral) the head of the femur was flattened and its articular surface eburnated. Similar changes were noted in the acetabulum, the labrum was gone and the acetabulum flattened out, i.e., the lunate surface was on the same plane as the fossa. In case 22, a female, the articular surfaces of the affected hip joint were eburnated, and again the acetabular fossa was flattened out. The osteophytes which were present circumferentially about the head extended like candle drippings onto the neck, particularly its anterior surface. These were flush with the head giving it a blunt conical shape which would have limited all movements, particularly abduction. In case 40, a female, the articular surfaces of both femoral heads were eburnated centrally, there remaining only a peripheral rim of cartilage, about one centimeter wide, interrupted inferiorly by a roughened triangular area extending out from the fovea. The lower halves of the lunate surfaces were likewise eburnated and pitted; only a thin layer of articular cartilage remained above. Thinning of the articular cartilages had allowed the "non-weight bearing area" of the femoral head to impinge on the acetabular fossa. Both of the femoral heads had become conical in shape and reciprocally the acetabular fossa likewise. The conical shape of the femoral head and of the acetabulum would have greatly restricted both abduction and adduction (fig. 1).

The findings in those cases where the osteoarthritis was of lesser degree are summarized below. A few cases are described in detail. Of the 112 individual joints examined, degeneration of the articular cartilage of the lunate surface was present in 62, being central in the great majority. It involved the posterosuperior sector and occasionally also the extremities of the lunate surface, which are anteroinferiorly situated, or diagonally opposite, in 32 of these (approximately 50 per cent). This suggested the possibility of a certain amount of leverage action having been allowed by a general thinning of the articular cartilage. The articular cartilages of the femoral heads showed evidence of degeneration in 52 instances, being centrally located in practically all.

In two instances (cases 3 and 24) degeneration of the articular cartilage of the head of the femur due to wear could be definitely related to contact with the acetabular labrum. In case 3, a laborer, the articular cartilage of the femoral heads showed deep linear wear posteriorly, where it had contacted the labrum when the thigh was moderately flexed, as perhaps in the stooped or kneeling position. There was an area of wear of lesser degree extending peripherally from this line, apparently due to contact with the acetabular labrum as the thigh was extended, as perhaps in resuming the upright posture. In case 24, a 74-year-old housewife, both femoral heads showed linear areas of wear anteriorly which corresponded to the area of contact with the acetabular labra when the thighs were slightly flexed. Extending peripherally from these lines were less worn areas which came in contact with the labra as the hips were further flexed.

In two instances (cases 4 and 32) there were found localized areas of osteophyte formation unilaterally at the acetabular margins in the posteroinferior sector at the point of transition between the overhanging acetabular roof and the area where it begins to fall away. In case 4 this was associated with a coxa vara deformity resulting from a malunited intertrochanteric fracture. In this case the labrum had been replaced anterosuperiorly by fibrous tissue due to unrelieved pressure of the superior aspect of the femoral neck against the acetabular rim. The articular cartilage of the femoral head appeared normal. In case 32 there had been a fairly recent intertrochanteric fracture, too recent, it would almost seem, to be the cause of the osteophyte formation. The transverse acetabular ligament in this case had become fibrocartilaginous in structure and had lost much of its elasticity.

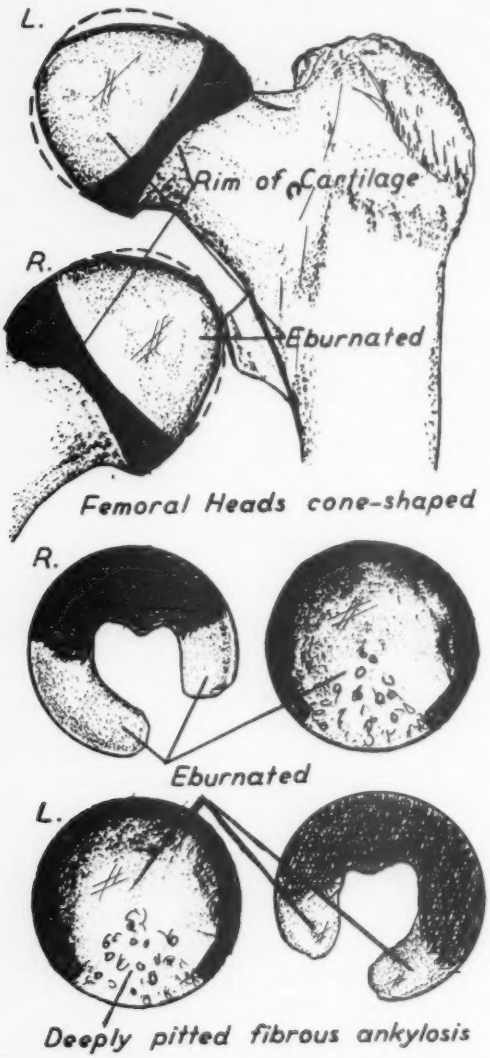

Fig. 1 — This figure illustrates the findings in case 40. Anteroposterior views of the two femoral ends and end-on views of the heads and acetabula are depicted. Note heavily-shaded peripheral rim of cartilage on the femoral heads and that the heads are cone-shaped: the lunate surfaces of the acetabula are eburnated below; the shape of the acetabula corresponds to that of the femoral heads. Abduction would have been greatly restricted.

There was degeneration of the articular cartilage of the femoral head centrally most marked posteroinferior to the fovea. A wedge of bone was removed from the acetabulum posterosuperiorly to assess the state of the articular cartilage of the lunate surface. It was found to be well preserved.

Degeneration of the articular cartilages of the femoral head and of the lunate surface of the acetabulum usually corresponded in degree but there were occasionally marked differences. Only two of the subjects were obese, so no conclusions regarding the effects of being overweight could be drawn. Case

37, a 71-year-old female who weighed about 400 pounds showed only a moderate degree of osteoarthritis in both hip joints. Case 34, a male aged 47 who weighed about 200 pounds, had normal appearing hip joints.

Other pathology of the hip joints noted in this study included single instances of the following: subluxation, (case 39); pyarthrosis, (case 25); an externally rotated but the joint surfaces appeared normal. It was previously noted that the usual posture in a contracture of the hip associated with osteoarthritis is one of flexion, adduction and external rotation. Case 25 illustrates the occasional occurrence of a pyarthrosis developing in an elderly person due to an obscure infection such as bed sores, etc., which has been al-

Table 2: Findings in a Representative Group of Shoulder Joints Showing Extensive Pathology. Note the Slight Preponderance of Females and That Complete Retraction of the Supraspinatus Tendon Is Associated with ++++ Osteoarthritis.

Case #	Age	Sex	Occupation	Rupture R.	Suprasp. L.	Osteoarthritis R.	Osteoarthritis L.
3	74	F	Housewife	+++	+	—	—
6	79	F	—	++	+	++	—
15	77	F	—	+++	—	—	—
16	81	M	Carpenter	+++	—	—	—
20	89	F	Housekeeper	+++	—	—	—
30	90	F	Prac. Nurse	+++	—	—	—
38	85	M	—	++++	++++	++++	++++
40	87	F	—	+++	—	++	—
49	78	M	Farmer	++++	++++	++++	++++
64	83	M	—	—	—	++++	++++
69	85	F	—	++++	++	++++	—
82	70	M	—	+++	—	—	—

Key to table 2: Osteoarthritis of the shoulder graded as for osteoarthritis of the hip (see key to table 1). Rupture of the supraspinatus tendon graded as indicated in figure 2.

ununited subcapital fracture of the femoral neck, the site of fracture having become a false joint (case 45). Case 39 illustrates the adverse effects of a prolonged posture involving flexion, adduction and internal rotation of the hip. This was a male in whom both hips and both knees were the site of flexion contractures. The left hip joint, which was flexed, adducted and internally rotated, was subluxated. The lunate surface on this side was worn in the posterosuperior sector, there being a central area of eburnation flanked by narrow strips of what appeared to be a synovial-like membrane. The adjacent labrum was no longer recognizable as such, but was represented by a thick fold of the capsule. There was considerable osteophyte formation at this site along the acetabular margin. The femoral head showed no adverse effects. The right hip was flexed, abducted and luded to by Gouley, McMillen and Bellet.[18] Case 45 was a 50-year-old male newspaper vendor, who had had an old ununited subcapital fracture of the right femoral neck. A false joint was present at the site of the fracture. The articular surface of the head of the femur was irregular in shape as if it had bulged out centrally into the acetabular fossa. The ligamentum teres was very thick and there were large synovial fringes. There was epiarticular ecchondrosis formation along the inner margin of the lunate surface posterosuperiorly. The central area of the cartilage of the head of the other femur was also roughened and prominent.

Shoulder joints (table 2). A chronic rupture of the supraspinatus tendon was present in 23 of the 170 shoulder joints examined. This was invariably near its insertion. The wear to the ex-

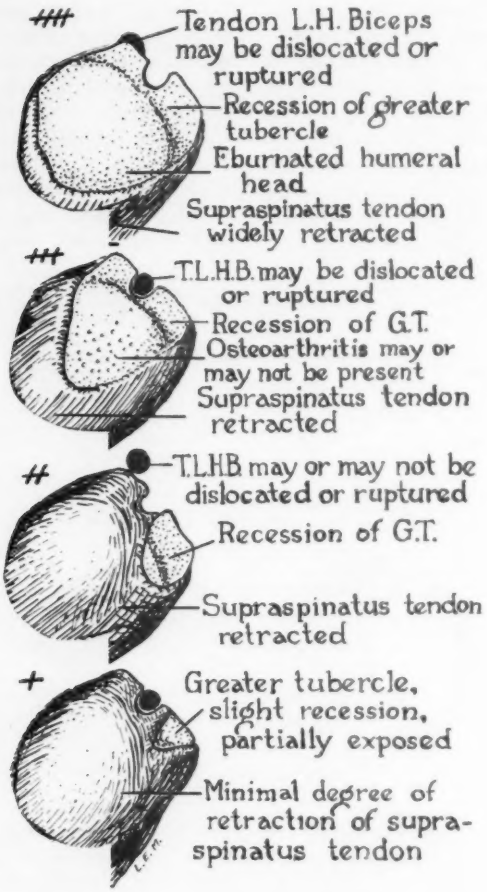

Fig. 2 — This figure illustrates diagrammatically a superior view of the capsule of the shoulder joint and of the humerus of representative specimens, graded ++++ to +, depending upon the degree of rupture and retraction of the capsule and supraspinatus tendon.

posed greater tuberosity was directly proportional to the area which came in contact with the overhanging acromion process. With complete retraction of the supraspinatus tendon osteoarthritis was always present. Where the tendon of the long head of the biceps had been exposed it was often found to be frayed out, dislocated medially (six instances) or even parted (six instances). The distal end of the tendon, under the latter circumstances, was usually found to attach to the lesser tubercle, as has been described by Horwitz[13] (fig. 2).

There was a complete defect in the floor of the subdeltoid bursa, or a complete retraction of the supraspinatus tendon (++++) in one or both shoulders, in two males and one female (cases 38, 49 and 69). In the two males the condition was bilateral; in the female the complete rupture of the supraspinatus tendon was confined to the right side: there was however a moderate (++) defect in the supraspinatus tendon on the left. In both males the humeral heads and glenoid cavities proper were alike eburnated. In one of these (case 49), a 78-year-old farmer, false glenoid

cavities had developed on the inferior surface of the acromion processes, their margins being formed by a mass of eburnated new bone, which was moulded to the shape of the humeral head. A huge buttress of osteophytes was present at the posterior border of the glenoid cavity proper of both shoulders. The 85-year-old female (case 69) had a false glenoid of fibrocartilaginous structure on the right. A similar condition was seen to be developing in the shoulder joint of an 89-year-old female (case 20) who had a lesser degree (+++) of tendon retraction. An elevated area of cartilage adjacent to the greater tubercle articulated with a fibrocartilaginous excrescence on the inferior surface of the acromion process.

There was an extensive (+++) but not a complete retraction of the supraspinatus tendon in eight shoulders in all, distributed among five females and two males with an age range of 70 to 90. Case 20 has already been mentioned, where there was a false glenoid but only slight damage to the articular cartilage of the humeral head. In case 40, an 87-year-old female, there was irregular pitting of the articular cartilage of the humeral head. In the other cases there was only a recession of the greater tubercle.

There were three cases, all above 79 years, where a (++) defect of the capsule was present. Any damage to the humeral head was confined to a recession of the exposed greater tubercle. There was one exception (case 6) in which the head of the humerus was irregularly pitted. The capsule had become so thin that it afforded little protection.

There were seven instances where a minor (+) defect in the capsule was present. The youngest of these was a 56-year-old housewife. The small defect in the capsule was directly over the tendon of the long head of the biceps which was, as a result, worn very thin.

In only one instance, an 83-year-old male (case 64), was osteoarthritis found in the presence of a normal capsule; the head of the right humerus and the glenoid cavity were nevertheless completely eburnated and a mass of osteophytes had formed about the glenoid margin posterosuperiorly. The tendon of the long head of the biceps was parted; the distal end had become reattached to the lesser tuberosity. On the left side the capsule was again intact; the articular cartilage of the humeral head was normal but the glenoid cavity was eburnated. No osteophytes were noted on this side, and the tendon of the long head of the biceps was intact and normal.

Arteries (table 1). There seemed to be no fixed correlation between the degree of atherosclerosis appearing in the abdominal aorta, iliac and femoral arteries, on the one hand, and the degree of osteoarthritis of the hip joint on the other.

Discussion

Osteoarthritis of the hip joint, apart from those cases secondary to other pathology, would appear to be accompanied, in the early stages, in most cases, by an instability of the joint. The latter is apparently due to thinning of the articular cartilages. Fibrosis and shortening of the capsule together with osteophyte formation subsequently develop and these limit motion. Any favoring of the joint and the assumption of a posture of flexion and adduction such as sitting with the thighs crossed, would favor the development of contractures. Only occasionally does one see a severe degree of adduction, flexion and lateral rotation deformity. The possibilities of such a habitual posture having any relationship to the deformity is seldom suspected by the patient. In the odd case the joint, being worn like a ground-glass stopper, becomes relatively immobile from the first, as in case 40. The pain of osteoarthritis may be due in part to inflammation of the synovial membrane; but as often it is probably due to stretching of the nerve fibers in the contracted capsule.

Osteoarthritis of the shoulder joint appears to be initiated, for the most part, by the instability resulting from chronic rupture of the supraspinatus

tendon and capsule, plus the exposure of the head of the humerus to direct contact with the acromion process. The articular cartilage of the glenoid cavity may remain intact or may be worn away. A complete defect of the capsule has been found only in the elderly. Inasmuch as this condition is seen as often (more often in this series) in females as in males it would appear that heavy manual labor is by no means the only cause. Contractures of the capsular structures about the shoulder joint is, as in the case of a similar condition in the hip joint, accompanied by pain.

Summary and Conclusions

With respect to the hip joint, osteoarthritis is certainly the most common pathologic disorder in the older age group. Ordinary wear probably is the principal etiologic factor. It is conjectured that thinning of the articular cartilages of the hip would result in some instability at first; a chain of pathologic processes is then set in motion which, in time, comes to limit motion. In other cases the parts may be reciprocally worn down into a conical shape as is illustrated in figure 1; in such a case hip motion, particularly abduction, would be limited from the first.

Chronic rupture of the supraspinatus tendon and capsule of the shoulder joint is relatively common in the older age group, the instability of the shoulder joint due to this cause may eventually lead to recession of the greater tubercle or frank osteoarthritis; if these are present the degree is proportional to the amount of retraction of the tendon and capsule, as is illustrated in figure 2.

Acknowledgments: The author is grateful to Dr. Harold Shryock, Professor and Head of the Department of Anatomy, and to Dr. F. B. Moor, Head of the Department of Physical Medicine and Rehabilitation, for helpful suggestions; to Mr. Robert Kaye, and to Mrs. Lucille Innes and other members of the Audio-Visual Department for their assistance in preparing the figures.

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Considerations of Intrasanatorial Functional Rehabilitation of Patients Suffering From Tuberculous Arthritis and Osteoarthritis

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● This paper points out that although the duration of the disease, skeletal tuberculosis, has been reduced and a number of cases can be healed with functional recovery, still a sufficiently large number of cases of osteoarthro tuberculosis are healed only at the price of one or even several joints being sacrificed. The patient suffering from tuberculosis of the skeleton presents a number of special features: the disease chiefly affects children, adolescents and young adults; it implies the rigorous immobilization of the entire body or segmental immobilization over long periods of time; and it more often than not finally means the total or partial loss of the articular function because of the course of the pathologic process or of operative obstruction. From this latter point of view it is important to distinguish the patients who exhibit sequelae that merely prevent them from doing certain work, and the disabled patients with multiple functional handicaps or handicaps involving important articulations. The latter are no longer able to make even half the effort necessary for normal labor. These and other considerations make necessary an occupation and qualifying therapy during hospitalization. An occupational orientation must not be forced upon the patient but must be deliberately acquired by him. Occupational and qualifying therapy as a main feature of intrasanatorial functional retraining is an adjuvant factor in the healing process and at the same time an important step in the series of methods applied for the patient's professional rehabilitation. Our efforts must be concerned not only with the healing of the disease itself but also with ensuring to our former patients conditions which will enable them to lead a normal life.

Because anti-tuberculous drugs were introduced into the therapeutic arsenal, the last decade witnessed remarkable changes in the anatomic patterns, clinical course and results obtained in the treatment of patients suffering from skeletal tuberculosis.

A sufficiently large number of cases of osteoarthrotuberculosis, however, are still healed only at the price of one or even several joints being sacrificed. This occurs despite the fact that the severe course of this disease, noted during the years preceding the antibiotic period, and postoperative complications are practically never met with now, that the course of the disease has been reduced by one-third to three-fourths of its former duration, and that a number of cases displaying skeletal tuberculosis—particularly juxta-articular osteitis and arthritic lesions which were synovial at the outset—can at present be healed with functional recovery.

It is particularly for such cases that methods must be found and applied which, in addition to the other features of the complex therapeutic plan, will on the one hand contribute to diminish dysfunctional sequelae and handicaps and, on the other, will ensure to the patient after he has left the sanatorium the possibility of carrying on some activity that is of benefit both to himself and to society.

The patient suffering from tuberculosis of the skeleton presents a number of special features, particularly in the following three aspects:

In the first place, the age factor: the disease chiefly affects children, adolescents and young adults, and brings about disturbances and arrests in normal physical and psychic development.

In the second place, the specific character in the course of osteoarticular tuberculosis — a disease of long duration— often implies the rigorous immobilization of the whole body or segmental immobilization over long periods of time.

In the third place, osteoarticular lesions more often than not finally mean the total or partial loss of the articular function owing to the course of the pathologic process or of operative obstruction. From this latter point of view it is important to distinguish on the one hand ablebodied tuberculosis patients, or "professional" tuberculosis patients who exhibit sequelae that merely prevent them from doing certain work, and disabled tuberculosis patients with multiple functional handicaps or handicaps involving important articulations. The latter are no longer able to make even half the effort necessary for normal labor.

Such factors, when combined, result in a number of morphologic and functional disturbances, some of which are: loss of fitness to perform work and sustain exertion; disorders of the digestive

and circulatory apparatus; psychic disturbances caused by being torn away from the usual familiar surroundings and working environments and of having to become integrated into a special sanatorial environment, and consequently, the obsession preying on the patient's mind that he will no longer be able to follow his former profession; total or partial loss of the functional capacity of one or several articulations, etc.

The above considerations necessitate occupational and qualifying therapy during hospitalization, such therapy to comprise the whole ensemble of measures to create for the patient pursuits and occupations which should be educational and reeducational and, also, a factor for rehabilitation as regards effort and work.

Functional retraining will help the body to re-establish a functional balance and will direct the adaptation to the new conditions of statics and motion.

Practice has shown that in order to obtain the best results a number of conditions must be fulfilled. To begin with, attentive judgment and appraisal of the possible invalidism with which the patient will leave his bed are required. The specialized physician and the expert for appraising the working capacity play an important part in establishing future occupational possibilities.

Secondly, an important factor is the cultural and occupational level. The problem for intellectuals is more simple, as regards the possibilities both of the patient resuming his former activity and his participation in rehabilitation, than it is for the craftsman and worker. In the event the foreseen invalidism is compatible with the carrying out of the former occupation, the steps to be taken will be concerned primarily with the preservation of the working capacity and with training. This is achieved by means of plaster apparatus which immobilize only those articulations which are strictly indicated, by means of functional gymnastics of the free joints and of respiratory gymnastics, by training for various work, either in bed (for those with Pott's disease or osteoarthritis of the lower extremities), or in rooms or workshops. The problem is more complicated for patients unable to resume their former occupation. They will have to be directed to the Labor Bureau of their specialty, or if this is not possible, steps must be taken to have them requalified. Those having a superior intellectual level will be directed to administrative work, bookkeeping, technical drawing, laboratory work, farming specialties, etc.

Unqualified patients may be qualified during their sanatorial stay by acquiring theoretical knowledge and by performing practical work in the most varied fields. Such work must be chosen as will develop the patients' manual and intellectual abilities in keeping with their future qualification: fret-saw work, wickerwork and plaited work, work in leather, linear drawing, embroidery, and weaving for patients who cannot leave the bed. For those who are able to move about, the following may be recommended: electricity, mechanics, joinery, lathe-work, harness-making, the making of prostheses, etc. Patients from rural areas will be oriented towards handicrafts required in the country.

Finally, it will be advisable that patients who are dismissed from the hospital with marked invalidism and a reduced functional and professional capacity be directed to artisan work which requires little effort and is well paid thanks to its artistic and special nature, such as optics, wood-carving, watch- and clockmaking, artistic leather work, etc.

Some countries have put into practice what has been stated above. In this country, schools for medical nurses were created in 1950 at the sanatoria Agigea, Vasile Roaita and Mangalia with very good results. In 1951, a planning and accounting school was created at Agigea, from which a number of good professionals are turned out every year from among patients who were unable to continue their former trade or profession. Likewise in 1950, handicraft circles were created at Mangalia for bootmaking, wickerwork and plaited work, weaving at specially constructed looms and adapted to the beds of the patients.

An occupational orientation must not be forced upon the patient but must be

deliberately acquired by him. Occupational and qualifying therapy as a main feature of intrasanatorial functional retraining is an adjuvant factor in the healing process and at the same time an important step in the series of methods applied for the patient's professional rehabilitation. The successive stages of this process are: occupational and qualifying therapy, readaptation to exertion by gradually diminished rest, readaptation to work and finally, resumption of work.

We conclude our paper by pointing out that this problem which is so important for the professional and social future of patients suffering from skeletal tuberculosis deserves greater attention than has hitherto been granted to it. Our efforts must be concerned not only with the healing of the disease itself but also with ensuring to our former patients conditions which will enable them to lead a normal life.

Information relative to securing reprints of this study may be had by checking the Reader Service column on page iv of this issue.

Deceased Members

DR. THEODORE H. COFFEY

Theodore H. Coffey of Wilton Grove, Ont., Can., passed away on May 10, 1961. Dr. Coffey was born Feb. 6, 1905. He was graduated from Queens University Faculty of Medicine, Kingston, Ont., in 1939; he was certified to the American Board of Physical Medicine and Rehabilitation and specialized in physical medicine. Dr. Coffey had been an active member of the American Congress of Physical Medicine and Rehabilitation since 1949.

DR. GEORGE D. WILLIAMS

George D. Williams of Logansport, Ind., died on July 14, 1961. Dr. Williams was born in Sarahsville, Ohio, on March 24, 1898. He attended Ohio State University College of Medicine and was graduated in 1922. Dr. Williams was certified to the American Board of Physical Medicine and Rehabilitation, a member of the American Academy and American Congress of Physical Medicine and Rehabilitation and a Fellow of the American College of Surgeons.

ARCHIVES OF PHYSICAL MEDICINE AND REHABILITATION

OFFICIAL JOURNAL

AMERICAN CONGRESS OF PHYSICAL MEDICINE AND REHABILITATION

AMERICAN ACADEMY OF PHYSICAL MEDICINE AND REHABILITATION

VOLUME 42 — January-December, 1961, Inclusive

All original articles published in the January through December 1961 issues are abstracted in this index. See page 856.

SUBJECT INDEX

This is an index of all the reading matter in the ARCHIVES, except the Medical News Department, which has been discontinued.

The symbols used to explain in which departments the matter indexed appears are as follows: "ab," abstracts, "E," editorial, "L," letter to editor and asterisk (*), an original article in the ARCHIVES.

This is a subject index and one should, therefore, look for the subject word, with the following exceptions: "Book Reviews" and "Deaths" are indexed under these titles at the end of the letters "B" and "D." The name of the author, in brackets, follows the subject entry. If there are more than three authors, only the name of the first author is given.

For author index, see page 835.

BOOK REVIEWS

C

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DEATHS

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INDEX TO PAGES

Of the Archives, According to Monthly Issues — Volume 42, January-December, 1961

AUTHOR INDEX

In this Index are the names of the authors which have appeared in the ARCHIVES, with the exception of book reviews and the survey of selected literature. These authors are listed under the headings "Book Reviews" in the subject index at the end of the letter "B." The Survey of Selected Literature is a separate index beginning on page 837. The asterisk (*) preceding the page reference indicates that the complete study is published in the ARCHIVES; "E" refers to editorial; "SA" refers to special article; "L" refers to letter to editor. For subject index, see page 821.

SURVEY OF SELECTED LITERATURE

Index for 1961

All articles abstracted and/or listed by title in the January through December, 1961 issues are listed in this index.

American Journal of Medical Sciences

American Journal of Physical Medicine

American Journal of Physiology

American Journal of Roentgenology

Annals of Physical Medicine

Archives of Neurology

Archives of Pathology

Arthritis and Rheumatism

Brain

British Medical Journal

Archives of Pathology

Arthritis and Rheumatism

Brain

British Medical Journal

Ergonomics

Geriatrics

Journal of Applied Physiology

Journal of Bone and Joint Surgery

Neurology

New England Journal of Medicine

Pediatrics

ABSTRACTS

The following abstracted articles have been published in the January-December, 1961 issues of the journal.

JANUARY

The Art of Physical Medicine. F. H. Krusen. *(pp. 1-5)*

● The International Federation of Physical Medicine was organized in May, 1950; it held its first International Congress in London, England, in July, 1952, and its second in Copenhagen, Denmark, in August, 1956. A study, carried out for the Federation by a committee of Danish physicians, indicates world-wide interest in physical medicine as a specialty. The combination of Physical Medicine with rehabilitation has occurred in 11 of the 20 countries surveyed. Teaching of Physical Medicine to undergraduate medical students is provided in 14 of these 20 countries. At the first congress, the president, Lord Horder, stressed the importance of clinical practice, and at the second congress, the president, Dr. Clemmesen, emphasized scientific research, so now it seems advisable to discuss the "art" of Physical Medicine. Although progress in Physical Medicine depends on good clinical practice and research, these achievements will be relatively sterile unless physiatrists are adept in the art of Physical Medicine. The art of Physical Medicine leads us to have a deep concern for the humanitarian, social and economic problems of our patients, and physiatrists are particularly concerned with the social and the community efforts in caring for the disabled. The specialists in this new medical discipline can provide the leadership for this mighty medical-sociologic movement in many countries. The art of Physical Medicine can lead us forward toward the goal devoutly sought by every man—health, peace and prosperity for all mankind.

Requests for reprints and/or information should be directed to: Section of Publications, Mayo Clinic, 200 First St., S.W., Rochester, Minn.

Electrodiagnosis Revisited: Tenth John Stanley Coulter Memorial Lecture. P. Bauwens. *(pp. 6-18; 12 figures)*

● Electrodiagnosis can be regarded as one of the many facets of physical medicine since it is merely a specialized form of investigation into the function of muscle. Complete electrodiagnostic examination is a trilogy consisting of study of muscle-behavior on stimulation, on electromyographic exploration and on electromyographic exploration during stimulation. In each case it is important to regard the structure examined and stimulated, not as an entity, but as a complex with a narrow range of characteristics in the normal state but a broader one in pathologic conditions. Pathology frequently is masked by normality and for this reason the plotting of intensity duration curves can be misleading. Electromyography at rest and on volition requires the patient's cooperation, but neither this nor consciousness is required when carried out during nerve or muscle stimulation. Moreover, it provides data for estimating the velocity of propagation of nerve impulses over different stretches of nerve trunk as well as for the rough evaluation of the prevalence of differential velocities along fibers. As excitability and velocity of conduction are both determined by the caliber of the axon, the results of these tests reflect the condition of the axon. It has been found expedient to coin the terms "axonostenosis" and "axonocachexia" to denote a local and a widespread reduction in girth of the axon, respectively. An important part of electromyography at rest, on volition and on stimulation is the search for muscle fibers which deviate from the normal and which provide clues of diagnostic value.

Requests for reprints and/or information should be directed to: Dr. Philippe Bauwens, St. Thomas' Hospital, London, England.

Etiology of Decubitus Ulcers. M. Kosiak. *(pp. 19-29; 10 figures and 1 table)*

● Eighty separate experiments were performed in an attempt to accurately determine the effect of both constant and alternating localized pressure on normal and enervated muscle. Localized pressures were applied over muscular tissue and the relationship between microscopic changes in the muscle and time and intensity of pressure was noted. Data compiled demonstrated the marked susceptibility of tissue to relatively low constant pressures for short periods of time and the somewhat greater resistance to change following the application of equal amounts of intermittent pressure. This was true of both normal and denervated tissue. A critical time interval at which pathologic change occurs in both normal and denervated skeletal muscle following the application of pressure was noted.

Requests for reprints and/or information should be directed to: Michael Kosiak, M.D., Department of Physical Medicine and Rehabilitation, University of Minnesota Medical School, Minneapolis, Minn.

Relationship of Progress in Speech Therapy to Progress in Physical Therapy. D. R. Boone. *(pp. 30-32; 1 table)*

● A study described in this paper indicates that patients who are so involved physically and psychologically that ambulation training is not possible, most of the time will not benefit from speech therapy. Among those patients who do well in physical therapy there is an approximate 50 per cent expectancy that improvement in speech will occur. No significant relationship was found between those patients who did well in physical therapy to the progress they made in speech therapy. Except for those hemiplegic and multiple sclerosis patients who do poorly in physical therapy, a prognostic index for speech improvement cannot realistically be based on the patient's present or predicted performance in physical therapy. Another implication found in the study is that among the large population of physically improving hemiplegic and multiple sclerosis patients, it is not possible to predict by physical status alone how well a patient will do in speech therapy. While a significant relationship was found between absence of progress in both speech and physical therapies, there was only a chance relationship between progress in physical therapy and similar progress in speech therapy.

Requests for reprints and/or information should be directed to: Daniel R. Boone, Ph.D., Director Clinical Speech Pathology, Cleveland Hearing and Speech Center, 11206 Euclid Avenue, Cleveland 6, Ohio.

Standard Routine and Procedure to Establish Uniformity in Clinical Electromyography. K. H. Haase. *(pp. 33-42; 7 figures and 2 tables)*

● The electromyogram is as essential to the physiatrist as the electrocardiogram is to the cardiologist. In order that electromyography achieve its proper place as a generally accepted diagnostic aid, standardization of the technic for examination is necessary. The method of examination which the author has evolved as a result of more than 8,000 examinations is presented. Electromyography is a dynamic examination which should be done only by a trained physician. In interpreting the results, the primary criterion for denervation should be the fibrillation of denervation voltage. The positive denervation sharp wave should also be considered as one of the criteria of denervation. The author also describes and explains myotonic voltages and dystrophic activity. The written electromyographic report should include the muscles examined with their peripheral nerve and root innervation. There should be a report of pathology found in each muscle examined. If there is evidence of denervation present, the level of the lesion should be indicated. There should be a statement as to whether the lesion is partial or complete. When indicated, a statement should be made as to the prognosis and as to the necessity for serial examinations.

Requests for reprints and/or information should be directed to: Karl H. Haase, M.D., 7743 Yarmouth Ave., Reseda, Calif.

Respiratory Status and Metabolic Requirement As Determined by Measurement of Carbon Dioxide Production. H. J. Ralston; G. Bard, and C. E. Chapman. *(pp. 43-46; 1 table)*

● Several investigators, most recently Ford and Hellerstein (J. Appl. Physiol. 14:891, 1959), have examined the relationship between pulmonary ventilation and oxygen consumption in normal human subjects, with a view to using ventilation alone as an adequate index of energy expenditure. As shown by Margaria, Taglietti, and Agostoni (J. Appl. Physiol. 11:235, 1957), the relationship between ventilation and carbon dioxide production may be even more useful, since it provides information regarding the respiratory dead space and the alveolar carbon dioxide tension as well as energy expenditure. The present report describes such studies on subjects with motor impairment. It is shown that ambulatory hemiplegic patients are characterized by a very small dead space, low alveolar carbon dioxide, and elevated ventilation for a given energy expenditure, compared with normal subjects. The respiratory status of certain other selected patients is also analyzed with the same method.

Requests for reprints and/or information should be directed to: H. J. Ralston, Ph.D., Biomechanics Laboratory, University of California, San Francisco Medical Center, San Francisco, Calif.

Electromyographic Evaluation of the "Cross Exercise" Effect. N. Panin; H. J. Lindenauer; A. A. Weiss, and A. Ebel. *(pp. 47-52; 7 figures and 1 table)*

● Early observations by Scripture (1894) and Davis (1898) have given support to the theory of transfer effects of contralateral exercise, leading to the creation of the term "cross exercise." Subsequent investigations of Wissler and Richardson (1900), Slater-Hammel, Hellebrandt, Parish, Houtz, Walters and Partridge were done with the purpose of confirming the theory of cross exercise. An increase in strength in contralateral nonexercised muscles was found by these investigators when the biceps was exercised against increasing loads. Recent electromyographic studies by Gregg, et al. were presented as further evidence of the cross-effect. Some doubt about the validity of this concept has been expressed by Mueller. Rose, et al, demonstrated muscle atrophy in a lower limb immobilized by a cast in spite of exercises given to the contralateral lower extremity. A complete denial of cross exercise effects was expressed by Kruse and Mathews on the basis of careful clinical experiments. It was our aim to check the effect of exercise on distant muscles in the body by means of multi-channel electromyogram, using skin electrodes. The right biceps and the right quadriceps were exercised: (a) without resistance: (b) with increasing loads; and (c) isometrically. The EMG potentials in actively exercised muscles and in distant nonexercised muscles of the upper and lower extremities were recorded. The presence and nature of the potentials is discussed in relation to exercise value.

Requests for reprints and/or information should be directed to: Alfred Ebel, M.D., 130 W. Kingsbridge Rd., New York 68, N. Y.

A Comprehensive Evaluation of the County Hospital Patient. J. W. Rae, Jr.; E. M. Smith, and A. J. Murphy. *(pp. 53-57; 4 tables)*

● The Department of Physical Medicine and Rehabilitation and the Division of Gerontology at the University of Michigan, with the cooperation of other interested groups within the University, are conducting a study of patients in selected county medical care facilities in Michigan. The purpose of the project is two-fold: to determine the medical status, functional ability, psychosocial level and vocational potential of patients in such institutions, and to introduce a demonstration program through staff and community organization to help the patients reach their maximum level of physical, social and vocational independence. The program is now underway in two county hospitals while patients in a third hospital without such a program are serving as a group for comparison. This article describes the method of the "multiple-discipline approach" used to evaluate the rehabilitation potential of the chronically ill patients in the Michigan county medical care facilities. A summary of the many medical entities found in the patients is presented as well as some of the remedial medical and physical restorative procedures recommended.

Requests for reprints and/or information should be directed to: James W. Rae, Jr., M.D., Department of Physical Medicine and Rehabilitation, University of Michigan Medical School, 1313 E. Ann St., Ann Arbor, Mich.

Rehabilitation of the Rheumatoid Hand by Surgical Means. E. D. Henderson and P. R. Lipscomb. *(pp. 58-62)*

● In the past 10 years surgeons interested in the hand have demonstrated that some disabling conditions and deformities of the hand due to rheumatoid arthritis may be treated effectively by surgical means. In certain of these conditions surgical treatment appears to offer real advantages over the traditional, more conservative, methods. This paper points out some of the indications for operation and the results to be expected. The authors emphasize that the operative approach is not used to improve the appearance of the hand but to improve function and to eliminate or reduce pain. Most of these operations can be done with use of local anethesia. The convalescence from primary surgical procedures, particularly the orthroplasties of the metacarpophalangeal joints, may require several months, with gradual improvement in function over the entire period of convalescence. Once a good result has been obtained, the improvement seems to be maintained, providing there is no serious flareup of the arthritis after the operation. Some of these operations have been done as long as four and five years ago. At present the place of surgical methods in the general scheme of treatment of rheumatoid arthritis is not formally established. It seems important, therefore, for physicians to be aware of the possibility of improving by surgical means the function of hands crippled by rheumatoid arthritis.

Requests for reprints and/or information should be directed to: Edward D. Henderson, M.D., Section of Publications, Mayo Clinic, 200 First St., S.W., Rochester, Minn.

The Nature of the Motor Deficit in Double Athetosis. T. E. Twitchell. *(pp. 63-67)*

● Athetosis is an instability of posture resulting from a disequilibrium between antagonistic physiologic mechanisms that are essentially reflex in nature. In the hands and feet these are the grasp reflex, determining flexion and adduction of fingers and toes, and the avoiding response determining extension and abduction. An imbalance of analogous reactions of the lips and tongue causes periodic pursing and parting of lips and protraction and retraction of tongue, while the purposeless movements of the head are related to visually determined pursuit and adversive reactions and poorly integrated righting reflexes. Inability to suppress the antagonistic member of one of these opposing responses impairs purposive movement in patients with double athetosis. In general, avoiding responses are prepotent leading to difficulty in fixing the eyes on an object, difficulty in reaching and grasping, and defective progression of gait. Less frequently, over-activity of grasping responses causes difficulty in releasing an object grasped. Further motor deficit results from inability to integrate neck and labyrinthine reflexes causing not only defective limb extension and adduction but also associated and mass movements. An intermittent intense resistance to passive movement in the limbs is related to overactive contact reactions and is identical in nature to the phenomenon of dystonia. All of these phenomena of double athetosis can be demonstrated in normal infants at certain stages of development and are of identical physiologic nature. The motor deficit of double athetosis, therefore, appears to result from defective sensory-motor integration with corresponding hypertrophy of infantile response.

Requests for reprints and/or information should be directed to: Thomas E. Twitchell, M.D., Joseph P. Kennedy, Jr., Memorial Hospital, 30 Warren St., Brighton 35, Mass.

Follow-up Survey Study of a Group of Elderly Above-Knee Amputees. B. J. Wolters, M.D. *(pp. 68-74; 13 tables)*

● Rehabilitation of an elderly above-knee amputee involves much more than supplying that person with a prosthesis. The absence of one or both lower extremities is but a part of the changes which have developed in such individuals with the course of the diseases which led up to the amputation. Some geriatric amputees maintain a high degree of resourcefulness and require little more than the provision of a prosthesis to regain physical and economic independence, but such cases are rare. As a rule, elderly above-knee amputees constitute a problem group to successfully rehabilitate because of the unique problems of this age group which complicate and even hinder rehabilitation altogether. The factor of

age by itself, however, is not of great importance to consider as a problem when the prescription of a prosthesis is involved. This study is directed toward defining more specifically these and related suppositions on the basis of experience with a group of elderly above-knee amputees who had received some help from the Rehabilitation Institute of Metropolitan Detroit during the past few years. Tables are included showing the distribution of the amputees as to sex, race, age, diagnosis, type of amputation, age of those amputees who were advised against prosthesis, civil status of amputees, financial status, functional classification, findings as to use of prosthesis and effect of age on functional classification.

Requests for reprints and/or information should be directed to: Burton J. Wolters, M.D., Butterworth Hospital, Grand Rapids, Mich.

FEBRUARY

Clinical Evaluation of a New Approach in the Treatment of Contracture Associated with Hip Fracture After Internal Fixation. J. F. Lehmann; W. E. Fordyce; L. A. Rathbun; R. E. Larson, and D. H. Wood. *(pp. 95-100; 6 tables)*

● Based on previous studies, it was assumed that ultrasound is the only heating agent which can raise the temperature in and around the hip joint to therapeutic levels and which can be used safely in the presence of metallic implants. Physiologically, ultrasound increases extensibility of tight periarticular structures and scar tissues; it also has a pain-relieving effect. Thus, if used in conjunction with other physical therapy procedures, it could be anticipated that ultrasound would be most effective in treating the joint contractures which tend to develop in the elderly patient with hip fracture after internal fixation. A statistical comparison of the results obtained with ultrasound and those obtained with infrared showed that ultrasound was significantly more effective. The study also clinically confirmed the safe use of ultrasound in the presence of metallic implants.

Requests for reprints and/or information should be directed to: Justus F. Lehmann, M.D., Professor and Executive Officer, Physical Medicine and Rehabilitation, University Hospital School of Medicine, University of Washington, Seattle 5, Wash.

Functional Electrotherapy: Stimulation of the Peroneal Nerve Synchronized with the Swing Phase of the Gait of Hemiplegic Patients. W. T. Liberson; H. J. Holmquest; D. Scot, and M. Dow. *(pp. 101-105; 3 figures)*

● The concept of "functional electrotherapy" implies the use of electrical stimulation in the process of carrying out effective movements by activating muscles which are paralyzed as a result of upper motor neuron involvement. This study is the beginning of the development of a research program inspired by the concept of "functional electrotherapy." In hemiplegic patients with foot drop, the electrode, made of conductive rubber, is applied to the skin area where the common peroneal nerve may be stimulated – below the knee. A large dispersive electrode is applied to the thigh or lower leg. A transistorized stimulator, which can be placed in the patient's pocket, is used. Thus, pulses of 20 micro-second duration of sufficient voltage, at a frequency of 30 per second may be applied. The electrical circuit is interrupted by a switch which is located in the sole of the shoe on the involved foot. The circuit is so arranged that during the swing phase, the stimulating current is on, while during the stance phase, it is off. With this arrangement, the gait of the patient is considerably improved without any bracing as the patient dorsiflexes the foot in the correct manner. During this study it was disclosed that the spontaneous dorsiflexion also is progressively improved. Therefore, the possibility of a carry over of the effects of "functional electrotherapy" on the effectiveness of the spontaneous gait of the patient also may be considered.

Requests for reprints and/or information should be directed to: W. T. Liberson, M.D., Chief, Physical Medicine and Rehabilitation Service, VA Hospital, Hines, Ill.

Second Year Review of Evaluating and Classifying the Vocational Potentials of the Cerebral Palsied. O. Machek and H. A. Collins. *(pp. 106-108; 5 tables)*

● A follow-up study of the vocational rehabilitation of the cerebral palsied adults for more than two years is presented. The job sampling technic is employed to estimate the vocational potential. A total of 188 clients were screened; 84 of them were approved for admission to the seven week project. During this time the team of workers carefully evaluate each patient and periodically meet and discuss them. The classification of each patient is given in four categories as the practical result of this study. Methodology of predicting employment of cerebral palsied is presented. ,

Requests for reprints and/or information should be directed to: Otakar Machek, M.D., 6500 Chippewa, St. Louis 9, Mo.

Function of Home Evaluations in Discharging Rehabilitated Severely Disabled from the Hospital. M. Peszczynski; B. H. Fowles, and S. P. Mahan. *(pp. 109-113; 1 figure)*

● One of the characteristics of the progress in rehabilitation methods is the blurring of the boundaries between the hospital and the patient's home. Some essential aspects of the physical and psychosocial atmosphere of the home are being introduced into the hospital, and reversely, the hospital is a more integral part of the community. Home evaluations play a considerable role in the transition of the rehabilitated severely disabled from the hospital to his home. We review the experiences gained from home evaluations done from Highland View Hospital. Particular problems of the hemiplegic patient, the patient with a fractured hip, the double above-knee amputee, the spinal cord injured patient, especially the quadriplegic, and the multiple sclerosis patient with advanced disability are discussed in some detail.

Requests for reprints and/or information should be directed to: Mieczyslaw Peszczynski, M.D., Chief, Department of Physical Medicine and Rehabilitation, Highland View Hospital, Cleveland, Ohio.

Systematic Classification of the Chronic Sequelae of Poliomyelitis. C. Vallbona and W. A. Spencer. *(pp. 114-121; 6 figures and 1 table)*

● The invasion of the central nervous system by the viruses of poliomyelitis has direct and indirect effects upon other systems of the organism. This may produce multiple clinical syndromes at different stages of the chronic phase of the disease. Some of these syndromes are the cause of early death in many patients. In others, the depletion of physiologic reserves appears to lead to premature aging of some physiologic systems. Experience acquired in the last 10 years in poliomyelitis respiratory and rehabilitation centers has led to identification and description of several syndromes that complicate the course of chronic poliomyelitis. A systematic classification of these chronic sequelae is presented and its relative incidence in the three major "anatomic" forms of poliomyelitis is indicated. Special emphasis ought to be given to the avoidance of injudicious scheduling of physical activities and treatments in individuals with residual paralysis of the respiratory muscles. An early diagnosis of these sequelae and the establishment of their immediate treatment are possible only by means of periodic examinations of the poliomyelitis patients. The most frequent signs and symptoms are reviewed and methods of evaluation are suggested according to the experience resulting from observations made in the Southwestern Poliomyelitis Respiratory and Rehabilitation Center on more than 1500 patients with poliomyelitis.

Requests for reprints and/or information should be directed to: Carlos Vallbona, M.D., Assistant Professor, Department of Rehabilitation, Baylor University College of Medicine, Texas Medical Center, Houston, Texas.

Diagnosis of Hysterical Paralysis. R. E. Worden; E. W. Johnson, and R. D. Burk. *(pp. 122-123)*

● The diagnosis of psychogenic paralysis is not difficult if the examiner is familiar with the bizarre response to tests displayed by this type of patient. A working classification of the etiologies of muscle weaknesses, apparent and real, is listed. The causes of abnormal gait patterns are presented. A list of clues is offered to help clarify the differential diagnosis. How electrodiagnosis tests provide helpful information is explained. A 16 mm. color film provides a pictorial study of salient points covered in the paper.

Requests for reprints and/or information should be directed to: Ralph E. Worden, M.D., Department of Physical Medicine and Rehabilitation, College of Medicine, University of California Medical Center, Los Angeles 24, Calif.

Modified Shoulder Saddle Harness for Upper Extremity Prostheses. L. F. Bender and J. W. Rae, Jr. *(pp. 124-127; 2 figures)*

● It has often been stated that the figure 8 is the harness of choice for upper extremity amputees. However, in Michigan where our adult amputee population largely is composed of farmers and industrial workers, a modified shoulder saddle has come to be the harness of choice. In the past year and a half the amputee clinic at the University of Michigan has prescribed prostheses for 28 upper extremity amputees (10 above and 18 below the elbow). Nineteen of these received the new shoulder saddle type of harness. Previous to this period most of our amputees had received the figure 8 harness. Several of our amputees have been provided with both the figure 8 and a new shoulder saddle harness. All of them preferred the shoulder saddle. In comparison with the standard figure 8 harness, the new shoulder saddle provides a larger weight-bearing area, more comfort while doing heavy work, the potential to lift heavy objects and no pull under the axilla on the normal side. It provides considerable improvement over the old type of shoulder saddle which used leather suspension loops running through D rings on the prosthesis. The new Bowden cable suspension permits much freer motion at the shoulder and obviates the former difficulty of the harness slipping around the chest due to the lack of free motion between the leather suspension straps and the D rings.

Requests for reprints and/or information should be directed to: Leonard F. Bender, M.D., Associate Professor, Physical Medicine and Rehabilitation, University of Michigan Medical Center and University Hospital, Ann Arbor, Mich.

MARCH

Influence of Weight-Bearing and Muscle Contraction on Disuse Osteoporosis. A. S. Abramson and E. F. Delagi. *(pp. 147-151; 1 figure)*

● Osteoporosis occurs where there is loss of function of sufficient degree. Standing and ambulation are among the most commonly used therapeutic measures to prevent or reverse such osteoporosis. No acceptable evidence exists that this form of osteoporosis is reversible. Recent metabolic studies also cast grave doubt upon the conception that weight-bearing can prevent it. A critical review of the literature suggests that despite weight-bearing, metabolic losses from bone will continue unless muscle contraction of sufficient degree is available to prevent them. It is pointed out that without any form of treatment, metabolic losses are self-limited.

Requests for reprints and/or information should be directed to: Arthur S. Abramson, M.D., Albert Einstein College of Medicine, New York, N. Y.

Postoperative Care in Lumbar Disc Syndrome. T. P. Anderson; E. Sachs, Jr.; R. G. Fisher, and R. M. Krout. *(pp. 152-158; 1 figure and 4 tables)*

● A review of the literature on results of surgery for lumbar disc syndrome reveals little information on postoperative care of the back. The purpose of this study is to assess the results of 179 such cases in which a careful evaluation of the mechanical aspects of the back, during the early postoperative period, was made. Therapeutic measures are individually prescribed. These include exercises for strengthening weak muscles of trunk and lower extremities; posture correction including protection of back while bending or lifting; correction of gait with cane(s), crutch(es) or brace; and other adjuncts such as heel lift and weight reduction. Results were evaluated by recheck visits one and two months after surgery in most cases and a questionnaire. Results were classified as excellent, 42 per cent; improved, 52 per cent; and unimproved or worse, six per cent. Only six cases (three per cent) required spinal fusion later. The low incidence of poor results and low incidence of fusion after disc surgery, both of which are better than most series reported in the literature, are attributed to (1) careful preoperative evaluation of all aspects of the back as well as the disc problem; (2) close cooperation during the early postoperative period between neurosurgeon and physiatrist, and (3) individually prescribed measures for total rehabilitation of the back.

Requests for reprints and/or information should be directed to: Thomas P. Anderson, M.D., Hitchcock Clinic, Hanover, N. H.

Motor Nerve Conduction Velocity in "Idiopathic" Polyneuritis. D. Cerra and E. W. Johnson. *(pp. 159-163; 1 figure and 1 table)*

● Twenty-two cases of "idiopathic" polyneuritis were followed up to three years with periodic motor nerve conduction velocity and electromyographic determinations. In all cases a reduced conduction velocity was valuable in the diagnosis. The decreased velocity preceded the electromyographic changes by one to two weeks and gradually increased paralleling clinical recovery, although, in several prolonged cases, it did not return to normal values. Frequently a temporal dispersion of the muscle action potential was the first indication of a reduced velocity. Supporting clinical data, biopsy studies, and a brief review of the literature are included.

Requests for reprints and/or information should be directed to: Domingo Cerra, M.D., Division of Physical Medicine and Rehabilitation, University Hospital, Ohio State University, Columbus, Ohio.

Special Appliances for the Disabled. R. H. Nyquist. *(pp. 164-166; 4 figures)*

● This paper describes a brace for the upper extremity, with attachments for eating, writing, shaving and brushing the teeth. The brace is partially a Georgia Warm Springs Foundation type with the addition of a "C"-bar and an opponens bar. The adaptive equipment is fastened to the brace at two different points, with a double key-hole type of fastening slot. The spoon for feeding is fashioned after a scoop shovel and is fastened to the brace by a swivel joint which allows gravity to keep the spoon level on the way from the plate to the mouth, decreasing spillage from the spoon. A "stop-bar" is arranged so that pressure can be afforded against this bar, holding the spoon so that it is more stable when food is scooped from the plate onto the spoon. The plate is equipped with a metal band to hold the food on the plate against the pressure of the edge of the spoon. This metal plate guard is held to the plate with a metal clip in a stronger manner than with plastic. Two attachments for writing include a "sliding bar" and a pencil holder. A metal holder is provided for an electric razor, and this holder can be swiveled to allow a better positioning on various parts of the beard. An attachment for the tooth brush allows swiveling and various positions for brushing the teeth on both sides of the mouth.

Requests for reprints and/or information should be directed to: Roy H. Nyquist, M.D., Chief, Physical Medicine and Rehabilitation Section, VA Hospital, Long Beach, Calif.

A Review of the Physiology, Measurement and Management of Spasticity. J. P. Roasenda and P. M. Ellwood. *(pp. 167-174)*

● This paper attempts to summarize the present state of our knowledge of spasticity. It contains a short historical resume of the work of many investigations in the field. The most widely accepted theories of the neuromuscular physiology of spasticity are explained with a discussion of facilitating and inhibitory mechanism, descending pathways to muscle, the organization within the spinal cord of mono- and polysynaptic junctions and the antidromic stimulation mechanism. Various methods

of measuring spasticity are reviewed. In addition, the numerous factors which increase or decrease spasticity, most of them difficult to evaluate, and less well known factors which influence the spasticity syndrome such as emotions and weather, are summarized. A review of the treatment technics, surgical and nonsurgical, is included. Conclusions of the study are that (1) our present knowledge of spasticity is highly theoretical and further studies are necessary on its physiology; (2) at present, no single satisfying method of measurement of spasticity is available; clinical impression still is the best method for evaluation, if well recorded, and (3) no single form of surgical treatment accomplishes, in a satisfactory way, relief of spasticity. The best medical methods relieve spasticity in a transitory fashion, but are of special importance in prevention and treatment of complications. Injection of peripheral nerves with procaine offers some hope as do various muscle relaxants, but the authors feel that satisfactory resolution of the basic problems of physiology and measurement will be necessary before definitive conclusions can be derived.

Requests for reprints and/or information should be directed to: Julio P. Roasenda, M.D., Kenny Rehabilitation Institute, Minneapolis, Minn.

Critical Factors in Electromyographic Instrumentation. J. B. Rogoff; E. F. Delagi, and A. S. Abramson. *(pp. 175-179; 2 figures)*

● The design of an instrument adequate for clinical electromyography should be dependent upon the parameters of the bioelectrical phenomena to be recorded. A critical review of current instrumentation is offered with pitfalls of possible faulty interpretation.

Requests for reprints and/or information should be directed to: Joseph P. Rogoff, M.D., Jewish Chronic Disease Hospital, 86 E. 49th St., Brooklyn 3, N. Y.

The Application of Psychometrics in the Vocational Evaluation of the Adult Severely Disabled. D. Spangler; C. W. Thomas, and M. Peszczynski. *(pp. 180-184)*

● A discussion of some criticisms, applications and trends in the use of psychometrics with the adult severely disabled. The widespread use, and sometimes misuse of tests, has led to the necessity for a sound methodologic framework in the vocational evaluation of these clients. In instances where instruments developed for non-disabled groups cannot be applied, emphasis is placed upon the development and standardization of tests for disabled groups. In addition, the authors report a technic, the THOMASAT, which was developed exclusively for the evaluation of cognitive-motor skills of disabled individuals as these are applied in a sheltered work situation. Current trends in this area are presented. Of particular importance is the increasing use of procedures which place minimal response demands upon the examinee; the development and modification of technics for the intellectual evaluation of the adult handicapped client and the utilization of pictorial technics especially constructed for assessment of the personality of these individuals.

Requests for reprints and/or information should be directed to: Donald A. Spangler, M.A., Highland View Hospital, Cleveland, Ohio.

An Analysis of Psychomotor Responses of Adult Hemiplegic Patients. C. W. Thomas; D. P. Spangler; S. Izutsu, and M. Peszczynski. *(pp. 185-188; 2 tables)*

● This paper presents the findings of an experimental technic in vocational appraisal employed in a hospital for chronic diseases. This technic is a psychomotor test designed to evaluate the motor skills of the upper extremities in determining work levels of individuals who have marginal vocational potential. The items in the test are constructed to evaluate the recognized hand functions and may be completed with one unimpaired hand. It also includes items which will evaluate tactile discrimination and eye-hand coordination. The findings are from a population of in-patients with disabilities which include hemiplegia, paraplegia, quadriplegia, multiple sclerosis, amputations, spinal cord injuries, and various other neurologic and orthopedic disabilities. Correlation studies were conducted utilizing measures of manual dexterity and general intelligence.

Requests for reprints and/or information should be directed to: Charles W. Thomas, M.A., Highland View Hospital, Cleveland, Ohio.

APRIL

Recognition and Care of Early Scoliosis. R. L. Bennett. *(pp. 211-225; 11 figures)*

● This paper discusses two common forms of scoliosis; paralytic and idopathic. All physicians who care for scoliosis must accept that structural deformity of the vertebrae and the rib cage cannot be altered to any significant degree by conservative, or even surgical procedures. For this reason, in individuals who have not reached skeletal maturity, all lateral and rotary deviations of the spine, regardless of how mild they appear to be, deserve deliberate and persistent treatment. If these beginning curvatures are recognized, most of them can be adequately controlled, and structural deformity kept at a minimum. The prevention of severe scoliosis is possible only if the physician is aware of the causative and accelerating factors that may be responsible for the development of a severe scoliosis. A curve must be considered structural and, therefore, dangerous when the spine shows asymmetrical mobility. Both hyper- and hypomobility are equally dangerous when asymmetrical. Combination types exist and have their characteristic patterns of progression. Obviously, all types of scoliosis cannot be prevented and treated in the same way and, while care must be strictly individualized, there are certain basic requirements common to all. All abnormal and asymmetrical stress against the proper alinement of the spine must be controlled insofar as possible. This will require such simple measures as weight and activity control, but might also require specific surgical measures such as release of iliotibial fascial contractures, reinforcement of the abdominal wall with fascial strips, and even early local fusion of the vertebrae. In general, it can be said that gymnastics have no place in the care of scoliosis.

Requests for reprints and/or information should be directed to: Robert L. Bennett, M.D., Executive Director, Georgia Warm Springs Foundation, Warm Springs, Ga.

Mechanical Properties and Temperature of Intact Skeletal Muscle in Patients with Muscular Dystrophy. S. Y. Botelho; E. Bendler, and S. B. Beckett. *(pp. 226-232; 4 figures and 1 table)*

● The authors have reported previously that stimulation of the ulnar nerve produces abnormal mechanical responses of intact thenar muscles in patients with pseudohypertrophic muscular dystrophy. We subsequently have measured muscle temperature and found that a low muscle temperature cannot be entirely responsible for the abnormal mechanical responses for the following reasons: (1) thenar muscle temperature in the patients with pseudohypertrophic muscular dystrophy was not abnormally low; (2) about the same decrease in temperature occurred during a period of one hour in the patients and in the normal subjects, and (3) in normal subjects, abnormal mechanical responses were not observed in muscles which had been rendered ischemic although there was a significant decrease in temperature. Analysis of the mechanical properties of thenar muscles of muscular dystrophy patients and normal subjects of varying ages has produced two observations, which suggest that the dystrophic process in the adult type may differ from that in the childhood type: (1) intact thenar muscles of adult dystrophics were as stiff whereas those of childhood dystrophics were less stiff than normal, and (2) when compared to normal subjects, potentiation of single twitch tension after a conditioning tetanus was of lesser degree, shorter duration and was even replaced by depression in the childhood but not in the adult type of muscular dystrophy.

Requests for reprints and/or information should be directed to: Stella Y. Botelho, M.D., G.S.M. Physiology, University of Pennsylvania, Philadelphia 4, Pa.

Analysis of Sounds from Normal and Pathologic Knee Joints. H. Fischer and E. W. Johnson. *(pp. 233-240; 11 figures and 2 tables)*

● Sounds from knee joints passively moved in a standard manner were picked up with a sensitive microphone, recorded on a magnetic tape and later analyzed with a sonic analyzer and visually on an oscilloscope. Twenty-five normal adults, 25 patients with rheumatoid involvement of the knee and 25 patients with degenerative arthritis (osteoarthritis) of the knee were studied. The gross wave pattern, energy output and the frequency distribution were compared in the three groups. Normal knees produced a relatively regular pattern with the surrounding soft tissue exerting a damping effect which is constant in any one individual. In rheumatoid arthritis the entire pattern is distorted, while in degenerative joint disease, there are high amplitude spikes superimposed on a normal pattern. Other less striking differences are discussed. A review of the literature is included.

Requests for reprints and/or information should be directed to: Herbert Fischer, M.D., Rehabilitation Institute of Chicago, 401 E. Ohio St., Chicago 1, Ill.

Effect of Short Wave Diathermy on Radio-Sodium Clearance from the Knee Joint in the Normal and in Rheumatoid Arthritis. R. Harris. *(pp. 241-249; 7 figures and 4 tables)*

● The radio-sodium clearance technic of Kety has been used to compare the effect of short wave diathermy on circulation in the normal and rheumatoid knees. In normal knees the increase in circulation averages 100 per cent. In quiescent rheumatoid knees there is a major increase averaging 60 per cent. In active rheumatoid disease major increases were not found, and in four out of five subjects there was a decrease in the circulation. This decrease is of the same order as found with intra-articular hydrocortisone and thus shows some rationale for using heat in treating active rheumatoid joints.

Requests for reprints and/or information should be directed to: Dr. Ronald Harris, Devonshire Royal Hospital, Buxton, England.

Evaluation of Physical Disabilities by Means of Patient Profile Chart. O. L. Huddleston; R. W. Moore; D. Rubin; T. L. Humphrey; J. W. Campbell, and R. Blanchette. *(pp. 250-257; 2 figures and 1 table)*

● For a long time a more effective and efficient method of evaluating physical disability and functional capacity has been needed in the field of physical medicine and rehabilitation. This paper presents a partial answer to this problem in the patient profile chart which was developed for this purpose. Values of muscle power and comparative functional capacities were arranged so that they could be recorded graphically for quick comparison and rapid evaluation. The functional activity scores and muscle grades are recorded by dots on the chart for the values measured, and subsequently connected from point to point to form a profile line. A muscle profile line is made for each side of the body and a single functional profile line is recorded for the functional tests. Subsequent profile lines are recorded at selected intervals and different colored profile lines are drawn for successive tests. In this way progress made by the patient may be compared easily by comparing the different colored profile lines. Also a quick comparison can be made between muscle power and functional capacity. The paper describes the clinical application of the patient profile chart and recommends that the chart be used as a research instrument in the future.

Requests for reprints and/or information should be directed to: O. Leonard Huddleston, M.D., 1 Pico Blvd., Santa Monica, Calif.

Application of the Stretch and Hoffman Reflexes to the Objective Measurement of Spasticity. O. E. Miglietta and M. Lowenthal. *(pp. 258-264; 5 figures and 4 tables)*

● Spasticity is encountered frequently in rehabilitation of patients with neuromuscular disabilities. The evaluation of spasticity and therapeutic procedures designed to control it remains a problem in clinical practice. Procedures previously described for objective evaluation of spasticity are either too elaborate for practical use or measure only in a qualitative manner the characteristics of the spastic muscle. We have approached the problem of evaluation of spasticity through a number of electromyographic parameters. This report describes experience with the stretch and Hoffman reflex in patients with various upper motor neuron disorders. The methods developed have been tested under clinical conditions and appear practical, readily reproducible and reliable. This presentation will describe the neurophysiologic factors involved, the technical features of the methods and their application in clinical settings.

Requests for reprints and/or information should be directed to: Osvaldo Miglietta, M.D., Department of Physical Medicine and Rehabilitation, Bird S. Coler Hospital, Welfare Island, New York 17, N. Y.

Special Rehabilitation Services in Certain Cardiac and Pulmonary Disabilities. C. D. Shie´ s and M. M. Kenrick. *(pp. 265-272; 5 figures)*

●During recent years improved diagnostic services along with improved surgical technics have increased the number of patients who are candidates for surgical procedures in cardiac and pulmonary disabilities. Many physicians with different types of training and numerous co-professional groups render essential services so that every patient will obtain the best results. Just as the indications for surgical procedures differ with each patient so may the rehabilitation services that are needed. All physicians concerned with the care of the patient are concerned with obtaining improved functional capacity. The physiatrist must understand the alterations in physiologic processes that result from conditions and diseases within the chest and from their surgical correction. The physiatrist must evaluate the patient prior to surgery to determine the status of his body mechanics. He also must be familiar with the social status of the patient, how this has been affected by his condition and what new hopes are stimulated by successful surgery or other medical service. Physical therapy and rehabilitation nursing should be introduced to the patient before the surgical procedure. After the operation physical therapy to improve body mechanics and to re-establish thoracic balance is indicated. Occupational therapy is essential to evaluate and to improve work tolerance and to introduce the patient to new horizons of activity. Social service and rehabilitation nursing have splendid opportunities for service to the patient after surgery. The patient who is a candidate for surgical procedures in cardiac and pulmonary disabilities will obtain best results when he receives complete rehabilitation services along with the best medical and surgical care.

Requests for reprints and/or information should be directed to: Charles D. Shields, M.D., Department of Physical Medicine and Rehabilitation, Georgetown University Hospital, 3900 Reservoir Road, N. W., Washington 7, D. C.

Cancer Arthritis and Rheumatoid Arthritis. B. Strandberg and N. V. Jarlov. *(pp. 273-278; 3 figures and 6 tables)*

● This paper reports on 53 patients with rheumatoid arthritis, with 91 normal controls. All 53 patients were hospitalized within the last five years for the diagnosis "rheumatoid arthritis." A repeated review of the 53 patients with rheumatoid arthritis shows that they can be divided into two groups. In one group of 27 patients the Hyland's rheumatoid-arthritis test is positive in 96.3 per cent of the cases; the alkaline phosphatase is not elevated; a paper-electrophoretic study of the serum proteins shows that the 2-globulins are elevated in 37 per cent of the cases, and the titer values of antihyaluronidase, antistreptolysin, and the streptococcal antibody correspond to the values found in major series of rheumatoid arthritis patients. The other group of patients comprises 26 patients in whom the rheumatoid-arthritis test is positive in only 3.8 per cent, where the alkaline phosphatase is elevated in 80.8 per cent and the 2-globulins in 100 per cent, while the 2-globulins, antistreptolysin titer, antihyaluronidase titer and streptococcal antibody titer show values corresponding to those of the normal controls. A repeated review of the latter group of patients shows that the rheumatoid arthritis signs and symptoms can be considered as the first clinical signs of later verified cancer.

Requests for reprints and/or information should be directed to: Dr. Brynjulf Strandberg, Copenhagen County Hospital, Hellerup, Denmark.

Role of Orthetics in Rehabilitation of Hands in Quadriplegia of Spinal Origin. O. F. von Werssowetz. *(pp. 279-285; 11 figures)*

● The essentials of any rehabilitation program for the quadriplegic patient is to provide independent function of hands with or without orthetic assistance. The selection of ortheses will depend on the severity and distribution of involvement and on the degree of complicating deformities and contractures. Most patients with quadriplegia of about the level of the sixth cervical vertebra will require adaptive ortheses. A satisfactory orthesis should attempt to replace and re-establish the normal basic hand-arm movement pattern consisting of four phases, that is reach, grip, carry and release. It is obvious that the last three are usually very severely limited. These require mechanical substitution to provide some type of holding device, and adequate stabilization of proximal joints and an independent release function. For these patients a tubular adaptive orthesis is preferred which permits easy exchange of every-day utensils which can be accomplished by the patient by gross movement without much dexterity. A new method of attachment of this holding device to the extremity was developed, utilizing hinged metal clasps on the forearm extension. These clasps are activated by leaf springs in the hinges and permit most patients to remove the ortheses independently of any outside assistance. The total result is a more functional individual.

Requests for reprints and/or information should be directed to: Odon F. von Werssowetz, M.D., Medical Director, Texas Rehabilitation Center, Gonzales, Texas.

Use of Nylon "Muscle" in Functional Bracing in Severe Quadriplegia. J. S. Young; B. S. Scott; V. Gordon, and E. Gilfoyle. *(pp. 286-289; 4 figures)*

● Minimum requirements for the functional use of the upper extremity are discussed. Photographic slides of a patient severely paralyzed as a result of a complete transection of the spinal cord at the level of the fourth cervical vertebra are presented showing the use of: (1) Flexor hinge splints operated by carbon dioxide activated nylon "muscles" to achieve bilateral chuck-type finger-thumb opposition. This is controlled by contralateral shoulder elevation using the trapezius muscles; (2) Ball-bearing feeders to achieve horizontal movement and rocker action; (3) Supinator aid on the ball-bearing feeder to achieve partial supination, and (4) Lastly, and the primary purpose of presenting this paper, synchronized forward flexion of the shoulder and flexion of the elbow to achieve raising one hand to the head region. This is accomplished by twin carbon dioxide activated nylon "muscles" acting upon the entire ball-bearing feeder mechanism. This is operated by a chin nudge control. A simple solution to the problem of preventing scapulohumeral rotation throughout this movement is provided.

Requests for reprints and/or information should be directed to: John S. Young, M.D., 1599 Ingalls St., Denver 15, Colo.

MAY

Changes in Blood Flow, Oxygen Uptake and Tissue Temperatures Produced by the Topical Application of Wet Heat. D. I. Abramson; R. E. Mitchell; S. Tuck, Jr.; Y. Bell, and A. M. Zayas. *(pp. 305-318; 4 figures and 3 tables)*

● The effect of periods of 20 to 30 minutes of topically applied wet heat on blood flow, tissue temperature and oxygen uptake in the forearm was studied in 52 experiments performed on 31 normal male subjects. This modality produced a marked increase in local circulation, with all structures contributing to the response, including tissues located three or more centimeters below the surface of the skin. Associated with the augmentation in blood flow was a rise in skin, subcutaneous tissue and muscle temperatures. Short periods of exposure were not as effective as prolonged heating in elevating muscle temperature. During the application of wet heat for short periods of time there was a definite increase in oxygen uptake. It was pointed out that, even if the change had been of small magnitude, the use of wet heat in the presence of arterial insufficiency would still be contraindicated, mainly because of a loss of the cooling mechanism provided by the rapid increase in blood flow normally elicited by heat. As a result, there would be a trend toward an abnormally high rise in tissue temperatures, with a consequent elevation of metabolic needs which could not be satisfied. It is concluded that topically applied wet heat is a potent vasodilating agent in increasing local blood flow and in raising tissue temperatures even in deep structures. Moreover, it compares even more than favorably with some of the elaborate procedures commonly used in physical medicine for such purposes, provided high temperatures, up to 45 C., can be maintained.

Requests for reprints and/or information should be directed to: David I. Abramson, M.D., Department of Physical Medicine and Rehabilitation, University of Illinois Research and Education Hospitals, 1819 W. Polk St., Chicago 12, Ill.

Myotonia Atrophica: Electromyographic and Endocrine Studies. A. Becker; R. Black; R. Lopatin, and M. Hauser. *(pp. 319-325; 1 figure and 2 tables)*

● This paper describes a mother and her son and daughter with myotonia atrophica. The mother showed a late onset of her disease and a masking of atrophy by obesity and coincidental diabetes mellitus. The son and daughter showed low 17 hydroxysteroid excretion; the son excreted subnormal amounts of 17 ketosteroids in the urine. Therapy with Meticorten, thyroid and triiodothyronine produced no beneficial effect. The description of the patients and the disease includes discussion of muscular involvement, endocrine changes, cataracts, and cerebral changes.

Requests for reprints and/or information should be directed to: Abraham Becker, M.D., 1414 David Broderick Tower, Detroit 26, Mich.

Recent Progress in the Collagen Diseases. E. W. Lowman. *(pp. 326-339; 9 figures and 5 tables)*

● Medical interest and progress in the field of collagen diseases have grown greatly in the past decade. This has largely been catalyzed by the introduction of steroids both as a treatment and as a research tool. As a result, basic understanding of the biochemical nature of collagen is broadening, diagnostic tests are being purified for greater specificity, treatment methods have been developed for considerably greater effectiveness and rehabilitation technics have been extended with success to the benefit of the chronically disabled patient. The important advances are discussed.

Requests for reprints and/or information should be directed to: Edward W. Lowman, M.D., Clinical Director, Institute of Physical Medicine and Rehabilitation, 400 E. 34th St., New York 16, N. Y.

Teaching of Rehabilitation in a Medical School. H. N. Neu. *(pp. 340-347; 3 figures)*

● This paper reviews the growth of departments of physical medicine and rehabilitation, the teaching of this specialty, and the nature of the medical school faculty which decides how the teaching of physical medicine and rehabilitation is conducted. For adequate teaching a service area for demonstration of the utilization of team personnel in a patient-centered approach is necessary. Presently-utilized areas, aspects of curriculum planning and what medical students should be taught concerning rehabilitation are discussed. Experience of the author and his associates has convinced them that it is illogical to assume that exposure to concepts of rehabilitation will result in a whole-hearted acceptance of them by all students. In each class, however, they have found that from 10 to 15 per cent of the students have exhibited much above average interest in the problem of chronic illness and the comprehensive care th[illegible] involved in such illness. This may appear to be a small number, yet if one considers that there probably are not more than five per cent of the physicians in the United States who are enthusiastically interested in the problem of rehabilitation, increasing this group to 10 to 15 per cent in our schools of medicine will create a large enough nucleus of physicians for the future who can meet the challenges that lie ahead.

Requests for reprints and/or information should be directed to: Harold N. Neu, M.D., 324 City National Bank Building, Omaha, Nebr.

Mineral Metabolism Following Poliomyelitis. F. Plum. *(pp. 348-362; 9 figures and 2 tables)*

● Controlled calcium and phosphorus balance studies have been performed in over 50 poliomyelitis patients whose degree and location of paralysis varied widely. During early convalescence, the intensity of hypercalciuria was nearly as great in mildly paralyzed patients as it was in the severely paralyzed and immobilized patients. However, the duration of hypercalciuria was directly related to the extent of paralysis: increased urinary calcium persisted in paraplegics for over six months and in many quadriplegics for over a year. Active and passive physical therapy, passive standing (tilt table) and early ambulation on crutches were evaluated for their effect on hypercalciuria. Physical therapy had no detectable effect on hypercalciuria and forced early ambulation was, at best, of equivocal metabolic value. In reversing the mineral loss, the muscular capacity for mobilization was apparently more important than was actual mobilization. The metabolic effects of the hormone, Nilevar, were studied in nine patients. Calcium excretion dropped to normal levels within three weeks, but a rebound of hypercalciuria followed drug withdrawal so that the net mineral loss was little changed by the therapy. Special attention was paid to preventing urinary calculi. Calcium intake was limited to 500 to 700 mg. daily. Prone positioning prevented genitourinary stasis of crystalline material. Daily urine output was maintained between 1,500 to 2,000 ml. When this program was initiated promptly after illness, only 5.5 per cent of respirator patients developed urinary stones. When the program was delayed for two months to three years, 26.5 per cent of respirator cases developed lithiasis.

Requests for reprints and/or information should be directed to: Fred Plum, M.D., Department of Medicine, University of Washington, Seattle 5, Wash.

Infirmary Rehabilitation of School Children with Cerebral Palsy. H. Sobkowicz; K. Warecka, and T. Zuk. *(pp. 363-370; 3 tables)*

● The authors have tried an infirmary rehabilitation of 10 children with cerebral palsy. The children were six to 15 years old. The rehabilitation treatment was divided into three periods: exercises in the hall, exercises in the water and pharmacologic treatment with Probamyl. All the children remained under a neurologic and electromygraphic control—examination before and after each period of the treatment and at two months after the end of the treatment. The whole treatment lasted 10 to 12 months. A clinical improvement was found in all the children during the treatment as well as some time after its end. The clinical improvement concerned the improvement of the movements of the child as well as the diminishing of the spasticity. The rehabilitation treatment has in view the improving of the muscle coordination activity; on the other hand it influenced very little the strengthening of the myostatic reflex. It is possible in this way to create or improve the dynamic stereotype of movement. The effect of Probamyl, examined on the basis of electromyographic tracing, seems to strengthen the central inhibitory influences, which in effect gives the tracing a shorter time of action and lessens the range and extent of pathologic reactions. The analysis of clinical and electromyographic examination suggests that a joint pharmacologic and rehabilitating cure would produce a more advantageous movement result.

Requests for reprints and/or information should be directed to: Hanna Sobkowicz, M.D., University Neurological Clinic, Academy of Medicine, Warsaw, Poland.

JUNE

Use of Physical Therapy Modalities in the Treatment of Orthopedic and Neurologic Residuals in Hemophilia. E. Austin; W. Rolland, and D. Clausen. *(pp. 393-397; 1 table)*

● The genetic and hematologic facets of hemophilia are well documented and treatment of the commonly occurring orthopedic problems resulting from hemorrhage into the joints has usually been limited to bracing and rest. One year ago it was decided to use the routine physical therapy modalities of electrical stimulation, ultrasound, and specialized forms of exercise including rhythmical stabilization, stretching, and progressive resistance exercises to determine if the acute episodes could be shortened and result in less residual disabilities. In addition, a series of young patients with chronic contractures and prolonged atrophy were treated. It has been found that when certain obvious precautions are observed, ultrasound is effective in reducing the residuals of hemorrhage into the joints or other tissues. It is more efficacious than electrical stimulation used for the same purpose. Electrical stimulation, however, has been useful in muscle reeducation as well as in the treatment of the peripheral nerve injuries which sometimes result from hemorrhage. The use of rhythmical stabilization exercises and progressive resistance exercises have resulted in increased power, greater stabilization about the joints with greater protection to them, and reduction of contractures. The supportive orthopedic care has been continued, but the treatment procedures have been of inestimable value to the patient and to his family, because for the first time he is being benefited by an active form of therapy.

Requests for reprints and/or information should be directed to: Elizabeth Austin, M.D., California Hospital, 1414 S. Hope St., Los Angeles 15, Calif.

Quantitative Muscle Testing: Principles and Applications to Research and Clinical Services. W. C. Beasley. *(pp. 398-425; 6 figures and 4 tables)*

● Progress in many phases of physical medicine and rehabilitation depends directly upon discarding traditional subjective methods of evaluation and adopting experimentally verified, objective and quantitative procedures for evaluating the effects from various types of treatment on neuromuscular functioning. Over the past 15 years the author has conducted intensive research continuously in the field of quantitative muscle testing for the explicit purpose of developing and standardizing methods and of accumulating basic knowledge that is a necessary foundation for systematic clinical evaluations. In the application of all clinical norms, there are three essential requirements: (1) a standardized method of measurement so that different examiners can obtain comparable results, that the same examiner can rely upon repeated tests from time to time, and that disturbing spurious factors can be minimized; (2) a body of pertinent information on the average value and variance of the function in normal population groups, and (3) a standard method for evaluating the significance of a patient's deviation. Selected examples are used to show how contributions from this research specifically apply to clinical evaluation of muscular strength, fatigability, and response of muscles to passive stretch. For each of these three neuromuscular functions, some results will be reviewed from research directed toward developing quantitative normal reference values and criteria for computing deviations from normal. The necessity for adjusting norms in relation to age, sex, body weight and other anthropometric factors are illustrated by several examples. The broad application of these contributions is stressed, such as (a) methods for computing percentage level of paresis; (b) sensitive methods for detecting changes in strength level as a result of treatment; (c) criteria for normal and abnormal rates of fatigability and (d) criteria for normal and abnormal response of neuromuscular systems to passive stretch of muscles.

Requests for reprints and/or information should be directed to: Willis C. Beasley, Ph.D., Director, Biophysics Research Laboratory, 105 Professional Building, 7942 Wisconsin Ave., Bethesda 14, Md.

Evaluation and Treatment of Low Back Pain Due to Mechanical Causes. F. J. Kottke. *(pp. 426-440; 12 figures)*

● Injury to the low back may be due either to a sudden extreme force which exceeds the compressive strength of bone or the tensile strength of ligaments and connective tissue, or to a prolonged stress which stretches ligaments and connective tissue and causes pain. In normal daily activity high tensile stresses are exerted against the ligaments and connective tissues in the low back. During periods of quiescence the muscles relax and support for the vertebral column is provided by the ligaments. Prolonged stress on these ligaments causes strain and pain. Under abnormal conditions of metabolic imbalance or inflammation the strength of bone and connective tissue is diminished and injury

may occur as a result of mild stress. Improper or inadequate support during bending, sitting or reclining may produce prolonged stresses which will injure these supporting tissues. Proper support during sitting is especially important. Evaluation of the patient with an injury to the low back must be thorough to establish whether there is injury to bone or joints, or compression of nerve roots. In all cases there is injury to connective tissues. The site of injury should be localized as definitely as possible by physical examination, functional tests and roentgenologic studies. Electromyography is useful to establish involvement of motor nerve roots. Adequate therapy includes support and rest so that healing can occur, relief of pain, removal of the products of inflammation, restoration of normal mobility and re-establishment of normal strength. Patients must be instructed in proper posture, precautions against back strains during daily activity, and exercises to maintain the mobility, strength, and endurance in the muscles of the back.

Requests for reprints and/or information should be directed to: Frederic J. Kottke, M.D., Professor and Head, Department of Physical Medicine and Rehabilitation, University of Minnesota, Minneapolis 14, Minn.

Electrodiagnosis and Electrical Stimulation in the Treatment of Neuromuscular Disorders. N. M. Liventsev. *(pp. 441-446; 9 figures and 1 table)*

● By studying the action potential, which reflects the dynamics of nerve trunk excitation, it is possible to determine the parameters of single electric pulses which may serve as the basis for therapeutic electrostimulation. Wedensky established the interdependence between the strength of a tetanic muscle contraction and the pulse frequency of electric stimulation. Anokhin showed that this interdependence is related to the functional state of the nerve trunk and that the frequencies which evoke optimal contraction in electrodiagnosis may be used to treat neuromuscular diseases. Experience has demonstrated that this approach substantially complements method of single pulse stimulation. In clinical practice the author also employs the simpler classical method of galvanic and faradic stimulation for electrodiagnosis. Following a comparative investigation of the two methods on 126 patients with neuromuscular disease the reliability of the simpler test could be validated. In treating neuromuscular disease with electrical stimulation, preference is shown for exponential pulses in a wide range of frequencies and durations of modulated amplitude. Such pulses are often less painful and cause less fatigue in injured muscles than rectangular pulses. By careful selection of duration and frequency, tetanic contraction could be elicited in impaired muscles even in patients with partial or slight reaction of degeneration. In many instances, especially those with only a partial loss of nerve trunk conductivity, a new method has been used which is called "active stimulation." Active stimulation is achieved by asking the patient to attempt voluntary (natural excitation) contraction of the impaired muscle at the same moment that the stimulating current is applied. In this manner, electrical stimulation facilitates or strengthens the contraction of the weakened muscle. In the author's experience, this method has been more effective in many cases than ordinary rhythmic stimulation.

Requests for reprints and/or information should be directed to: Prof. N. M. Liventsev, State Research Institute of Balneology and Physiotherapy, Kutusova 4, Moscow, U. S. S. R.

Electromyographic Studies in Myopathies and Related Conditions. M. A. Perlstein; M. Turner, and H. Elam. *(pp. 447-457; 3 figures and 3 tables)*

● An electromyographic study was done of 53 patients with various neuromuscular disabilities. The study showed: (1) Patients with cerebral palsy were electromyographically normal. (2) Patients with poliomyelitis sequelae demonstrated the typical findings of lower motor neuron lesions, namely fibrillation at rest and primarily polyphasic potentials during effort with an inability to recruit interferential patterns on maximal effort. (3) In pseudohypertrophic muscular dystrophy, dystrophic and polyphasic potentials were most commonly seen during voluntary effort. Myotonic potentials occurred in over one-half of the patients. Fibrillation potentials at rest occasionally occur. It is felt that such fibrillation potentials may represent denervation primarily at the muscle pole as contrasted to the denervation in polio which is primarily at the neural pole. Minimal voluntary effort will generally cause synergistic muscle action with resulting interferential patterns. (4) Facio-scapulo-humeral dystrophy is characterized by electromyographic patterns identical with that of pseudohypertrophic muscular dystrophy except for the absence of myotonic potentials. (5) Amyotonia congenita is characterized by mixed electromyographic patterns, at times similar to that of a polio and at times that of a muscular dystrophy. No myotonic potentials are present. In some patients maximal effort may elicit only simple patterns and in others minimal effort may elicit interferential patterns.

Requests for reprints and/or information should be directed to: Meyer A. Perlstein, M.D., 4743 N. Drake Ave., Chicago 25, Ill.

An Approach to Biomedical Instrumentation. H. W. Shirer. *(pp. 458-474; 7 figures)*

● The nature of the subject quantity and the form in which the output data is desired are the primary considerations necessary to specify a measuring instrument system. Such systems are made up of three basic components; an input sensing element to provide a signal proportional to the subject quantity, an output indicator to convert the signal to a scalar deflection, and a modifier to make the sensor signal suitable for the output indicator. The general characteristics and problems peculiar to each of the components are discussed and some basis for their selection suggested.

Requests for reprints and/or information should be directed to: Hampton W. Shirer, M.D., Biological Sciences and Systems Department, General Motors Technical Center, Warren, Mich.

Study of Growth Patterns in Cerebral Palsy. J. S. Tobis; P. Saturen; G. Larios, and A. O. Posniak. *(pp. 475-481; 3 figures and 3 tables)*

● The heights and weights of 86 cerebral palsied children have been measured and found to be significantly below the accepted standards for American school children and below that of an unselected clinic population matched with the patient group in relation to age and ethnic background. Followup measurements one year later, and a more complete anthropometric study including bone-age estimation and determination of proportions of body parts have been done on 50 of these patients. Correlation of growth deviations with degree of clinical disability and with intelligence is presented. Factors affecting growth in brain-damaged children and the relationship between the magnitude of neuromuscular involvement and the amount of growth impairment are discussed.

Requests for reprints and/or information should be directed to: Jerome S. Tobis, M.D., Department of Physical Medicine and Rehabilitation, Montefiore Hospital, 210th and Bainbridge Ave., New York 67, N. Y.

JULY

Compensation for Contracture Deformity in an Improved Socket Design for Above-Knee Prostheses. M. H. Anderson; J. J. Bray, and C. O. Bechtol. *(pp. 485-491; 7 figures)*

● Between March, 1956, and June, 1958, a total of 301 quadrilateral suction socket prostheses were fitted as part of the teaching activities of the Prosthetics Education Program of the University of California Medical School at Los Angeles. Accurate records were kept of stump perimeters, socket inside perimeters, flexion and abduction contracture angles, and stump condition. These records were analyzed in June, 1958, and three problems appeared to be serious enough in approximately 50 per cent of the cases to warrant further study. These problems were edema in the distal portion of the stump, wide-base gait, and excessive anterior pelvic rotation. Differing methods and instruments were developed for making accurate measurements of the amount of flexion contracture that would have to be compensated for in prosthesis socket design if anterior

pelvic rotation were to be held to 10 degrees or less; for making accurate measurements of abduction contracture, and methods developed for designing the socket to compensate for such contracture, to hold the gait base to not more than two inches. Methods were developed for shaping the socket with shoulders inside to give support to the end portion of the stump. Sixty prostheses have been fitted using these technics between September, 1959, and June, 1960. Follow-up observation and examination indicate that edema has been markedly reduced and in most cases eliminated, and stump condition improved. Anterior pelvic rotation is held to a maximum of 10 degrees and gait base to a maximum of two inches.

Requests for reprints and/or information should be directed to: Miles H. Anderson, Ed.D., Prosthetic Education Department, UCLA Medical Center, Los Angeles 24, Calif.

Acute Soft Tissue Calcinosis. S. G. Feuer and O. Fliegel. *(pp. 492-497; 4 figures)*

● Acute deposit of calcium salt in soft tissues is a morbid entity often mistaken for acute cellulitis, gout or the like. It has been observed in various areas of the upper and lower extremities. The natural history of the disease as well as its clinical and x-ray appearances are discussed. A series of nine cases with x-ray illustrations is presented. The condition, termed acute soft tissue calcinosis, is classified as belonging within the group of extra-skeletal calcinosis, the chronic forms of which have been described as calcinosis interstitialis, circumscripta, tumerous, respectively. Calcareous gout or "Kalkgicht," a term originated many years ago by German authors who believed that a particular "diathesis" comparable to genuine gout made the patient liable to these conditions, has been abandoned because of lack of evidence of distinct laboratory features, though it is an alluring concept. It will be demonstrated that this condition is a self-limited one. On the basis of this experience, the treatment is discussed. Essentially, the differential diagnosis of this condition and that of calcified tendinitis and bursitis is extremely important to the physiatrist because of the wide variation in type of treatment. The latter calls for a dynamic program of physical therapy and exercise, whereas the former will be shown to respond adequately to physiologic rest.

Requests for reprints and/or information should be directed to: Samuel G. Feuer, M.D., 195 Hicks St., Brooklyn, N. Y.

Isometric Exercises in the Paraplegic and in the Patient with Weakness of Quadriceps and Hamstrings. J. W. Gersten. *(pp. 498-506; 6 figures)*

● Earlier studies have demonstrated that isometric exercises were effective in increasing muscle strength and endurance. Tension development, and not anoxia, was responsible for the improvement in strength. In the following experiments the primary aim was to study the effect of isometric and isotonic exercises on muscle function in the upper and lower extremities. The triceps of paraplegic patients, and the quadriceps-hamstrings of patients with weakness of these muscles were investigated. In all studies one side was treated with isotonic exercises, while the contralateral extremity was treated isometrically. Isometric tension, 10 repetition maximum and integrated electrical activity of the muscle were recorded. Increase in 10 repetition maximum was always markedly and significantly greater than increase in isometric tension. In general, isometric and isotonic exercises produced similar improvement. In the few instances in which significant differences existed these were always in favor of isometric exercises. Maximal improvement in triceps function was generally achieved within five weeks. In the quadriceps and hamstrings, however, not only did increase in function continue during the entire period of study, but the magnitude of his increase was almost twice as great as in the triceps. The amount of triceps exercise, the factor of weight-bearing in the lower extremity, and electrical activity in the triceps were examined in order to throw some light on this difference between the two groups of muscles. None of these factors was found to be contributory.

Requests for reprints and/or information should be directed to: Jerome W. Gersten, M.D., 4200 E. 9th Ave., Denver 20, Colo.

Paramyotonia Congenita, Clinical Features and Electromyographic Findings. W. J. LaJoie. *(pp. 507-512; 6 figures and 1 table)*

● The purpose of this paper primarily is to present electromyographic findings in several cases of paramyotonia congenita, before, during, and after exposure to cold. In addition, the clinical symptoms and description are reviewed and the genetic chart of one family brought up to date. Paramyotonia congenita is a hereditary disease involving the neuromuscular system and manifested principally by paralysis of muscle groups exposed to cold. This reaction is reversible by heating. This disease apparently is only transmitted by a parent who also has the disease and is not known to occur in children where both parents are free of the disease. The symptoms of paramyotonia congenita are evident in infancy. They are not progressive with age nor is the longevity of the individual with paramyotonia congenita affected. These people apparently live a reasonably normal social and economic life. Electromyographically, certain abnormal potentials are evident similar to myotonic potentials. These are most evident in the small muscles of the hands and feet. These potentials and all other electrical activity disappears in the muscle when it becomes "paralyzed" due to cold.

Requests for reprints and/or information should be directed to: William J. LaJoie, M.D., 2021 N. Central Ave., Phoenix, Ariz.

Pressure-Volume Relationships in Emphysema Patients Before and After Breathing Exercises. H. McKinley; J. W. Gersten, and L. Speck. *(pp. 513-517; 2 figures and 1 table)*

● Intraesophageal pressures and measurements of respiratory volume were made in six patients with pulmonary emphysema, before and after one month of breathing exercises. Measurements of total work, elastic work, non-elastic work, and active expiratory work per liter were made. Symptomatic improvement, in terms of decrease in dyspnea, was reported by five patients. Decreases in all phases of work except for elastic work were produced by Isuprel, although only the decrease in active expiratory work was statistically significant. Although there were no statistically significant changes in work after one month of breathing exercises, there was a strong tendency toward an increase in all work aspects except for elastic work.

Requests for reprints and/or information should be directed to: Harriet McKinley, M.S., Fitzsimons General Hospital, Denver 8, Colo.

AUGUST

Electromyographic Kinesiology of the Hand; Part II. Third Dorsal Interosseus and Extensor Digitorum of the Long Finger. C. Long, II; M. E. Brown, and G. Weiss. *(pp. 559-565; 5 figures)*

● Electromyography has made it possible to record the actual function of muscles during normal motion. Several investigators have shown that muscular function at the shoulder, at the elbow, and in the lower extremities does not follow rules inferable from origin and insertion alone. Through the medium of simultaneous electromyography and motion picture photography, our research group has been studying the relationship between the intrinsic and extrinsic musculature of the normal, moving hand. The first aim of the study is to differentiate between those motions possible to a certain muscle group and those actually performed by it. We have delineated specific motions which isolate the particular functions of the intrinsic and extrinsic muscles. Forty-four normal subjects have been tested in 70 experiments. The last nine of these have satisfied our own criteria of scientific acceptability. These experiments included the third dorsal interosseus and the extensor digitorum to the long finger. The dorsal interosseus is active during metacarpophalangeal flexion when the interphalangeal joints are extending or being held stiff by the subject; it is not active during closing of the full hand. It is usually active when the interphalangeal joints are being extended, regardless of the position or direction of

movement of the metacarpophalangeal joint. The extrinsic extensor is active when the metacarpophalangeal joint is extending or being held extended. It is not active during stiff-fingered flexion of the metacarpophalangeal joint, nor during the combined motion of metacarpophalangeal flexion and interphalangeal extension.

Requests for reprints and/or information should be directed to: Charles Long II, M.D., Highland View Hospital, 3901 Ireland Dr., Cleveland 22, Ohio.

Electromyographic Method for Objective Measurement of Muscle Relaxant Drugs. C. R. Peterson and C. S. Wise. *(pp. 566-572; 7 figures and 1 table)*

● An objective method is described for measuring the effects of a muscle relaxant drug, carisoprodol (SOMA), in man under acute controlled conditions. Electromyographic measurements of the patellar reflex in 23 patients with upper motor neuron disease were made during a control period and for approximately two hours following administration of the drug or placebo. Statistical evaluation of the depression of the quadriceps action potential in those patients receiving the drug revealed a significant difference from the controls (p equals 0.05 or less). The method described appears to be applicable to screening and comparative evaluation of the neurospasmolytic agents.

Requests for reprints and/or information should be directed to: Charles S. Wise, M.D., Director, Department of Physical Medicine, George Washington University Hospital, 901 23rd St., N. W., Washington 7, D. C.

A Study of Peripheral Nerve Involvement in Fifty-Four Patients with Multiple Sclerosis. O. Miglietta and M. Lowenthal. *(pp. 573-578; 2 tables)*

● Involvement of peripheral nerves is not a prominent feature of multiple sclerosis, at least in the chronic stage and does not represent a problem in rehabilitation. Out of 5 examined three were found to have one or more peripheral nerves involved, in two of these the lesion was clearly due to compression. A brief resume with the most prominent findings of these three cases is given. This observation points to the need for careful consideration and attention to be devoted to the positioning of the patient in bed, wheelchair or Stryker frame to avoid a further damage being added to an already fragile organism.

Requests for reprints and/or information should be directed to: Osvaldo Miglietta, M.D., Department of Physical Medicine and Rehabilitation, Bird S. Coler Hospital, Welfare Island, New York 17, N. Y.

The Management of the Patient with Cerebral Infarction. L. D. Policoff. *(pp. 579-583)*

● The prognosis for functional recovery from a cerebral vascular accident with motor paresis is contrary to widespread medical opinion, less dependent upon the extent of neurologic involvement than upon the type and severity of the disease process which is present in the brain tissue. The best prognosis for functional recovery will be found in the young individual with a post-traumatic hemiparesis and the worst prognosis in the elderly individual with extensive cerebral insufficiency present before the development of the acute cerebral arterial infarction. Several common complications of which the physician must be aware before he can properly manage the patient with cerebral vascular disease are discussed. Problems of and suggestions for the management of the patient during the convalescence and rehabilitation period are described and given. The principles of management of patients which are briefly spelled out involve the basic concepts of physiologic and anatomic bed positioning, early mobilization, extensive muscular retraining and the re-teaching of functional activities within the limitations of the presenting disability utilizing the residual capacities and augmented by adaptive devices and braces. The author believes the majority of patients with a cerebral infarction can be restored to some degree of community and family living and no patient should be denied the privilege of such a management program.

Requests for reprints and/or information should be directed to: Leonard D. Policoff, M.D., Albany Medical Center Hospital, Albany 8, N. Y.

The Management of the Patient with Arteriosclerosis Obliterans. L. D. Policoff. *(pp. 584-589)*

● The clinician has available to him a rather wide variety of therapeutic technics in the long term management of patients with arteriosclerosis obliterans. Many of these technics are useless and some actually may be detrimental to the welfare of the patient. Some of the technics are described. The patient requires scrupulous attention to the principles of cleanliness, warmth and avoidance of trauma. Drug therapy and sympathectomy have a very limited place in the management of this problem and are useful for only specific indications. Proper management of this condition will diminish morbidity and, even in the presence of the ultimate catastrophe of amputation, shorten the period of disability.

Requests for reprints and/or information should be directed to: Leonard D. Policoff, M.D., Albany Medical Center Hospital, Albany 8, N. Y.

The Medical and Social Outcome of 200 Respirator and Former Respirator Patients on Home Care. G. M. Harrison, Jr. and M. B. Mitchell. *(pp. 590-598; 7 figures and 3 tables)*

● The authors, a physician and a medical social worker, evaluate the medical and social outcome of 111 male and 89 female patients with residual involvement of respiratory muscles resulting from poliomyelitis. The methods, as well as the personnel, employed in conducting comprehensive studies in the patients' homes and in the respirator center on return visits are discussed. In this group of 200 individuals, the ages range from two to 46 years; 58 per cent are 20 years of age or older. The duration of time on home care ranges from less than one to five years or more. The majority of these patients are described as being severely involved; 64 per cent still require the use of mechanical breathing aids. The most frequent intercurrent medical problems are caused by upper respiratory infection. It is the authors' impression that these infections decrease in frequency as the patient's time on home care increases. The major medical problems arise from progressive scoliosis in approximately 32 per cent of the cases and the formation of renal calculi in 17 per cent. There are indications that in general the impact of home care has been more severe for the family members than for the patient. The criteria for measuring this impact, as well as some of the resulting disruptions are discussed at length. Totally apneic and quadriplegic post-poliomyelitis patients can be handled safely and comfortably in their own homes. It is concluded also that the success of the home program and the extent to which the patient resumes his former role in the family and society are based primarily on psycho-social factors rather than on the extent of the patient's physical disability and his medical problems.

Requests for reprints and/or information should be directed to: G. M. Harrison, Jr., M.D., Texas Institute for Rehabilitation and Research, 1333 Moursund Ave., P. O. Box 20095, Houston 25, Texas.

The Kim Self-Starter for Wheelchair Patients (A Self-Help Device). K. H. Kim. *(pp. 599-601; 3 figures)*

● For a quadriplegic to stand safely on a tilt board there must be two strong persons available to help him on and off the board. In this paper the author describes a standing device which eliminates the need for attendants and enables a quadriplegic patient (level of the fifth, sixth, seventh and eighth cervical vertebrae) to achieve independence in standing; requires minimum assistance for the quadriplegic of the fourth and fifth cervical vertebrae level; eliminates the need for bilateral long-leg braces for the high cord level paraplegic patient who is not functionally ambulatory and has difficulty standing by himself, and enables non-ambulatory paraplegics who are ataxic or who have lost their sense of balance to stand independently without braces or other assistance. The machine operates electrically with a simple switch for up or down motion; it adjusts to fit individual patients; it stops automatically when the proper height is reached;

it can be stopped anywhere along the cycle if the patient's position is wrong, and a properly fitted seat belt, arm crutches, etc., provide safety for the patient and a feeling of security.

Requests for reprints and/or information should be directed to: Ki Ho Kim, M.D., Kessler Institute for Rehabilitation, Pleasant Valley Way, West Orange, N. J.

Some Observations on Bell's Palsy in Belfast During the Period 1949 to 1958. G. Gregg. *(pp. 602-608; 3 figures and 8 tables)*

● The anatomy, pathology and treatment of Bell's palsy are discussed and certain characteristics are examined in the 661 patients treated at the Royal Victoria Hospital, Belfast, during 1949 to 1958. It is estimated that the average annual incidence of Bell's palsy in Belfast is 160 cases per million of the population. The data give no evidence of the condition being relatively more often affected than the other. Of the patients treated 29 per cent had their sense of taste and two per cent their sense of hearing involved while the Ramsay Hunt syndrome was present in three per cent.

All but 20 patients responded to treatment and of the 641 that did so, 484 (73%) are considered to be "cured" and 157 (27%) "improved." There is no evidence that sex or side affected influenced the cure rate, but the cured group were on average five years younger than the improved. Of the cured patients 73 per cent had symptoms lasting for less than 10 days before treatment began compared with only 63 per cent of the improved; only three per cent of the cured had symptoms for more than 50 days compared with as many as eight per cent of the improved. Treatment was completed in less than 30 days for 70 per cent of the cured compared with only 35 per cent of the improved. Interpretation of this difference is difficult because of the tendency to extend treatment of the improved in the natural desire to achieve cure. Attempts were made to estimate the association between durations of symptoms and treatment.

Requests for reprints and/or information should be directed to: Dr. George Gregg, 40 Elmwood Ave., Belfast 9, North Ireland.

Lethal Effects on Several Common Dermatophytic Fungi by Ultraviolet Light After Exposure to Compounds of the Furocoumarin Group. V. E. Mikkelson; E. W. Fowlks, and D. G. Griffith. *(pp. 609-613; 2 figures and 4 tables)*

● This project is designed to determine whether Trichophyton Rubrum, a common source of fungus infections in humans, can be effectively killed with ultraviolet light after exposing the organism to various furocoumarins. A definite enhancement of the lethal effect of ultraviolet light through the photosensitization of various bacteria and fungi with several furocoumarin compounds has been noted by a group at the University of Oregon Medical School under Fitzpatrick. Their work was primarily investigating the melanin stimulating effect of ultraviolet light, and no investigation of the potential use of this method in treating fungus or bacterial infections has been undertaken to date. This project is aimed at investigating such potential.

Requests for reprints and/or information should be directed to: V. E. Mikkelson, M.D., U. S. VA Center, Domiciliary, Wilshire and Sawtelle Blvds., Los Angeles 25, Calif.

Carbon Dioxide Actuated Clamp for Quadriplegic Bladder Training. A. E. Comarr and R. Snelson. *(pp. 614-615; 4 figures)*

● Another remotely controlled bladder training device is presented which is very adaptable for use in bed, wheelchair or on a guerney, especially for those quadriplegics who have absolutely no voluntary motion of the upper extremities. Its usefulness is self-evident for the tetraplegic who has retained some motion.

Requests for reprints and/or information should be directed to: A. Estrin Comarr, M.D., VA Hospital, Long Beach 4, Calif.

SEPTEMBER

School Services for Physically Handicapped Children in Urban Areas. H. M. Wallace. *(pp. 631-638; 12 tables)*

● This paper reports on the findings of a survey conducted in 1958 to ascertain the status of school services for children with orthopedic, neuromuscular, or neurologic conditions in cities having a population of 100,000 or more. Wide variation exists in the range of services, policies and personnel provided. Suggestions are made so that these children may have the benefit of essential services in all urban areas.

Requests for reprints and/or information should be directed to: Helen M. Wallace, M.D., U. S. Children's Bureau, Department of Health, Education and Welfare, Washington, D. C.

Perception in Hemiplegia: III. The Judgment of Relative Distance in the Visual Field. H. G. Birch; F. Proctor, and M. Bortner. *(pp. 639-649; 3 tables)*

● The ability to judge the relative distance from the observer of objects in visual space was studied in 24 hemiplegic and 10 non-neurologically damaged patients. It was found that monocular perception of distance relations was impaired in hemiplegics, but that the binocular perception of such relations was not different in the hemiplegic and in the control subjects. The findings are discussed in terms of the impairment of inferential functioning in hemiplegia.

Requests for reprints and/or information should be directed to: Herbert G. Birch, M.D., Ph.D., Department of Pediatrics, Albert Einstein College of Medicine, New York 61, N. Y.

The Effect of Ultrasound on Conduction Velocity of Peripheral Nerve. P. W. Madsen, Jr., and J. W. Gersten. *(pp. 645-649; 4 figures)*

● The purpose of this study was to extend the information concerning the effects of ultrasound on human nerve in situations comparable to those in common clinical use. Changes in temperature of subcutaneous tissue and in conduction velocity of the ulnar nerve following exposure to ultrasound were investigated. The ulnar nerve region, in the forearm, was sounded in the normal human subject. Conduction velocity in the ulnar nerve and temperature of subcutaneous tissue were measured. When "sounding" was done without energy emission, both temperature and conduction velocity decreased. Conduction velocity decreased even at intensities of 0.88 and 1.28 watts/cm.^{2} With an intensity of 1.92 watts/cm.^{2}, there was a relatively small increase in temperature (0.5° C.) and in conduction velocity (0.8 per cent). At intensities higher than this the temperature rise was smaller. If the area covered by the sound head was decreased the temperature rise and increase in conduction velocity were proportionately increased.

Requests for reprints and/or information should be directed to: Jerome W. Gersten, M.D., University of Colorado School of Medicine, 4200 E. 9th Ave., Denver 20, Colo.

Cervical Spondylosis as a Cause of Spinal Cord Pathology. B. Sandler. *(pp. 650-660; 6 tables)*

● Cervical spondylosis is a disease of unknown etiology characterized by degenerative intervertebral disc changes and osteophytic formations impinging upon the nerve roots and spinal cord. It is believed that trauma plays a role in triggering the process of bone proliferation. Cord symptoms are thought to develop because of direct cord compression and angulation due to the ridges on the posterior margins of the vertebral bodies; and ischemia from compression of the anterior spinal artery and veins. The disease appears to be more prevalent in males and usually causes symptoms in the fourth decade or later. There may be a sense of heaviness or coldness in the arms and legs, aching in the legs, dysesthesiae, impairment of position and vibration sense, impairment of temperature sense, difficulty with

gait including ataxia. Objective findings may include hyperreflexia, toe signs, sensory deficit atrophy and fasciculations in the musculature of the upper extremities. Laboratory investigation may show elevated protein in the cerebrospinal fluid, but often there is no abnormality. The differential diagnosis demonstrates that the disease is often confused with amyotrophic lateral sclerosis, subacute combined syndrome, multiple sclerosis, cord tumor and even cerebrovascular disease. The accepted surgical procedure is cervical laminectomy and section of the dentate ligaments. However, it should be noted that the benefits to be derived from surgical intervention are not yet clearly known.

Requests for reprints and/or information should be directed to: Bernard Sandler, M.D., 132 Cecil St., S. E., Minneapolis 14, Minn.

Panel Discussion: Role of Government in Rehabilitation. F. H. Krusen; L. E. Burney; J. E. Fogarty; G. Harlem; H. H. Humphrey; L. W. Larson; M. E. Switzer, and C. B. Wynn-Parry. *(pp. 661-682)*

● The role of government in rehabilitation is discussed by congressmen, government administrators and an American Medical Association spokesman. Such topics as the responsibility of the Public Health Service in research, service and facilities and the background of need and accomplishment in government programs are explored. Participants ranged from the viewpoint that much more needs to be done by government as well as by voluntary agencies in the field of rehabilitation to the viewpoint that the encroachment of government into the field of individual health can always extend to depersonalize and dehumanize medical service. Government programs in the field of rehabilitation in England and in Norway are described and explained.

Requests for reprints and/or information should be directed to: Frank H. Krusen, M.D., Director, Kenny Rehabilitation Institute, 1800 Chicago Ave., Minneapolis 14, Minn.

OCTOBER

Special Article: Management of Lower Extremity Amputees. A. S. Russek. *(pp. 687-703; 1 figure and 1 table)*

● In this study, each part dealt with is a broad subject in itself. Some details were explored in the area of indications and surgery of amputations. As consultants, physiatrists are called upon to advise surgeons in the realm of rehabilitation so that a familiarity with the advantages of amputation and its technic are essential. Elementary details and controversial material have been deliberately eliminated so that this review represents the middle ground of common knowledge and accepted practice. An attempt has been made to demonstrate the place of amputation surgery in rehabilitation. Management of the amputee was presented as a step-by-step procedure under continuous medical supervision. Principles of preprosthetic preparation, prescription and training have been placed in their perspectives, pointing out that these are not isolated activities but part of an over-all correlated program.

Requests for reprints and/or information should be directed to: Allen S. Russek, M.D., 400 E. 34th St., New York 16, N. Y.

Trigger-Point Injection: Its Place in Physical Medicine. A. L. Cooper. *(pp. 704-709; 3 figures and 2 tables)*

● The trigger-point phenomenon is an extremely common syndrome in the physiatrist's practice. An understanding of the pathophysiologic mechanism of the trigger point will enable the physiatrist to direct his prescription to the real source of trouble. Obviously, symptomatic treatment can meet with only partial success. Knowledge of the trigger-point phenomenon will aid the diagnostician in understanding otherwise inexplicable symptoms. The injection of local anesthetics to interrupt the vicious cycle of pain can materially shorten the time of recovery of patients suffering from the trigger-point syndrome. The technic should be an integral part of the armamentarium of every physiatrist.

Requests for reprints and/or information should be directed to: Albert L. Cooper, M.D., 742 Medical-Dental Building, Seattle, Wash.

Electromyographic Data in Idiopathic Scoliosis. J. Le Febvre; A. Triboulet-Chassevant, and M. F. Missirliu. *(pp. 710-711)*

● A series of 35 cases of idiopathic scoliosis and faulty posture was examined by serial electromyograms taken at various stages of development of the deformity. Skin electrodes were applied at four centimeter intervals on a double axis, three centimeters laterally from the spinal crest. Three areas were explored: the high dorsum, low dorsum and lumbar area. All cases of paralytic scoliosis and of scoliosis due to skeletal malformations were eliminated from the series. The remaining 35 cases of idiopathic scoliosis were subdivided into two main groups depending on the presence or absence of a tilt or imbalance of the pelvis. The groups were further subdivided on the basis of the number of curvatures present. An over-all predominance of the amplitude and intensity of the action potentials was observed on the convex side of the curvatures. This asymmetry of the action potentials appeared early in the course of the disease and was found to be a reliable sign for the recognition of active and progressive forms of scoliosis. Electromyographic evaluation also permits an appraisal of the efficacy of corrective maneuvers.

Requests for reprints and/or information should be directed to: Dr. Jacques Le Febvre, 76 Rue Notre-Dame des Champs, Paris VI, France.

Use of Celastic for Temporary Bracing in Peripheral Nerve Injuries. I. Muss, and N. Lamport. *(pp. 712-715)*

● Use of Celastic for the fabrication of temporary bracing represents an effective method of treatment in physical medicine. Cases of peripheral nerve injury involving the radial, median, and ulnar nerve (alone or in combination) can be fitted with a Celastic splint for proper positioning. Temporary splints can also be adapted to paretic extremities, including foot drop following paraplegia or peripheral nerve involvement. The Celastic also adapts itself to the temporary fabrication of pylons in the upper extremity to which may be affixed tools for the retraining of function. The use of the temporary splint or brace in no way takes the place of regular bracing or splinting but merely acts as a stop-gap during the acute period. During the time the permanent brace is being fabricated, which in many instances requires several weeks, the Celastic splint prevents overstretching of a part or fibrosis and fixation of a joint.

Requests for reprints and/or information should be directed to: Israel Muss, M.D., VA Hospital, Louisville, Ky.

Vocational Rehabilitation of the Quadriplegic. R. A. Walker. *(pp. 716-721)*

● This paper discusses the general contribution of a rehabilitation program in the attainment of employment goals for the quadriplegic patient. For this discussion quadriplegia is defined as an injury, rather than a disease process, to the cervical cord. The adjustment mechanism of quadriplegics as well as the attempt to help them develop attitudes which facilitate rehabilitation are discussed. Although the number of vocational goals is limited there still are a substantial number of employment objectives for quadriplegics. They find their best outlet in occupations in the professional, technical, managerial, clerical, and sales areas. The limited information available on quadriplegics indicates that the bulk of them are employed at home but factors concerning employment possibilities outside the home and the part the vocational counselor plays in reaching decisions on whether the quadriplegic can work outside the home are considered in this study. Other responsibilities of the counselor and the role of all team members concerned with the quadriplegic also are discussed.

Requests for reprints and/or information should be directed to: Robert A. Walker, M.A., 1900 Chicago Ave., Minneapolis 4, Minn.

NOVEMBER

The Importance of Rehabilitation in the Treatment of Chronic Pulmonary Emphysema. A. Haas, and A. Luczak. *(pp. 733-739; 6 figures and 1 table)*

● The national incidence of chronic obstructive pulmonary emphysema is in excess of one million. Sufferers from this crippling disease are burdening the economy and seriously affecting the welfare of families. Usually they have been given only symptomatic relief with antibiotics and bronchodilators, which do not affect the progress of pulmonary changes.

It is not sufficiently recognized that rehabilitative measures are as important in the treatment of chronic obstructive pulmonary emphysema as in treatment of neuromuscular-skeletal disorders. Proper breathing exercises and technics affecting postural drainage have not been customarily used. There has been a general skepticism about these procedures, possibly because their effectiveness has not been scientifically demonstrated. Spirometric evaluation has been attempted, but was found not sufficiently sensitive for detection of significant changes following breathing exercises. The value of these measures to date has been determined solely by the subjective reactions of patients or the judgment of the clinician.

Obviously, if patients handicapped by pulmonary insufficiency can improve their breathing pattern, they are bound to make better use of their diminished cardiopulmonary reserve. Treatment which achieves this result is basic. Our own clinical observation led to the belief that intensive rehabilitative measures are of great value and justify laboratory study. Further, we found that improvement in pulmonary function after respiratory exercises can be readily determined by measurements of energy cost plus oxygen debt and evaluation of recovery.

Accordingly, a five-year study sponsored by the Office of Vocational Rehabilitation was undertaken at the Bellevue and Goldwater New York University Rehabilitation Services, in order to determine whether therapeutic breathing exercises can improve poor pulmonary function; what change in energy cost of activities of daily living occurs after therapy, with comparisons of oxygen debt and recovery in performance of these activities before and after treatment, and whether patients can be rehabilitated to a great degree of self-sufficiency, and realize vocational goals.

Requests for reprints and/or information should be directed to: Albert Haas, M.D., Director, Chest Rehabilitation Service, New York University-Bellevue Medical Center, 1st Ave. at 27th St., New York 16, N. Y.

Local Injection of Corticosteroids in Treatment of Musculoligamentous Injury. E. Lipow, and C. S. Wise. *(pp. 740-749); 5 figures and 1 table)*

● This paper reports the technic and results of local infiltration of soluble prednisolone phosphate used alone or in combination with other steroids and local anesthetics in a wide variety of soft tissue injuries. Rapid reduction of swelling and alleviation of pain are prime objectives for earlier rehabilitation. The soluble corticosteroid is more rapid, acting with maximum effectiveness usually within 24 hours. The less soluble suspension, such as prednisolone tertiary-butylacetate, contributes a more sustained anti-inflammatory and fibrinolytic effect. The technic of "flooding" large areas is described, as well as that of combining corticosteroids with hyaluronidase, where ecchymosis or edema are prominent features. Typical case reports, including collateral ligament strain, epicondylitis, cervical strain, low-back strain, ankle strain and bicipital tendinitis, are included.

Requests for reprints and/or information should be directed to: Eugene G. Lipow, M.D., 1150 Connecticut Ave., N.W., Washington 6, D. C.

Special Article: Natural History of the Intervertebral Disc. E. E. Gordon *(pp. 750-763; 3 figures)*

● Associated with growth and maturation is denaturation of the collagen and mucopolysaccharides of the intervertebral disc. Denaturation changes are ubiquitous and inevitable, although the stage may vary from person to person of the same age and even from disc to disc in the same person. This process in the nucleus pulposus leads to loss of elasticity and, consequently, interference with radial dispersion of forces. Simultaneously, aging in the annulus fibrosus produces a fibrous, rigid structure which becomes the seat of fissures and frank tears due to constant thrust from within by a nucleus less efficient in transmitting forces equally in all directions and so incapable of minimizing them in any sector of weakened resistance. This background of dynamic processes affecting the sensitive internal milieu that comprises the intervertebral disc may offer a rationalistic approach to a multiplicity of clinical syndromes involving the vertebral column. Certain conclusions may then be postulated regarding the diverse nature of "discogenic" pain commonly seen in the neck and low back regions.

Requests for reprints and/or information should be directed to: Edward E. Gordon, M.D., Department of Physical Medicine, Michael Reese Hospital, 29th St. and Ellis Ave., Chicago 16, Ill.

Comparative Outcomes of Respiratory Poliomyelitis Patients Treated from Onset and in the Chronic Phase of the Disease. R. R. Jackson; W. A. Spencer; G. M. Harrison; L. K. Smith; M. B. Mitchell, and K. E. Ware. *(pp. 764-773; 4 figures)*

● From a total case load of over 2,500 poliomyelitis patients the authors observed and treated 199 acute and 146 chronic poliomyelitis respiratory patients through 1959. These 445 surviving respiratory patients have been consecutively admitted and all have been treated under the same program so that some comparisons may be made. In this report the authors have examined the comparative outcomes from the points of view of: (1) respiratory aid emancipation; (2) residual muscle strength estimates and capability for independent function (feeding, hygiene, communication, etc.); (3) range of motion; and (4) some aspects of sequelae and medical complications. The results seem to indicate a more favorable outcome for the patient who has comprehensive management available from onset. This is evidenced by: (1) 84 per cent of patients managed from onset are safely freed of their breathing aid at first discharge contrasted with 20 per cent of those transferred to the Center in the chronic phase of the disease. (2) Muscle test strength estimates show a striking difference in the two groups. The group managed from onset shows an average strength increase of 22 per cent in the first year after onset and over one-half the patients have 70 per cent or more residual muscle strength (recovery) at one year or later from onset. Less than one-fourth of the chronic patients showed greater than 50 per cent residual total body muscle strength (recovery) over the same time span. (3) There is a significant difference in residual flexibility (range of motion). Twice as many of the chronic patients had tightness about joints that limited function as did those managed from onset. (4) Likelihood of survival evidenced by long-term mortality of the patients seen late was over three times that of patients managed from onset. Discussion of some of the factors likely to account for these differences are presented.

Requests for reprints and/or information should be directed to: Robert R. Jackson, M.D., Director of Education and Research, Craig Rehabilitation Hospital, 1599 Ingalls St., Denver 15, Colo.

Etiology of Decubitus Ulcers: An Experimental Study. O. Lindan. *(pp. 774-783; 16 figures and 2 tables)*

● The concept of assessing the relative significance and mode of action of various factors contributing to decubitus ulcer formation is presented, using an experimental approach. A "decubitus threshold pressure" has been established for healthy animals, i.e. a minimum degree and duration of pressure resulting in well defined tissue changes leading to necrosis. A "minimal pressure lesion" in healthy man, showing minimal but specific structural and functional alterations in the skin, due to pressure alone, has to be defined. Using these two standard pressure indices the role of contributing factors (metabolic, infective, neurological) resulting in increased sensitivity of tissue to the effect of pressure, can be examined. A method is described for measuring the external pressures to which a pa-

tient's skin is subjected in hospital circumstances, and the "pressure isobars" so obtained are illustrated. An animal model has been devised, using rabbits' ears, whereby a constant tissue response is obtained according to the duration and magnitude of pressure applied.

Requests for reprints and/or information should be directed to: Olgierd Lindan, M.D., Ph.D., Highland View Hospital, 3901 Ireland Dr., Cleveland 22, Ohio.

DECEMBER

50 Card Test: Clerical Task as a Screening Device for Organic Brain Damage, Report on Preliminary Findings. A. Kameny. *(pp. 785-790; 2 tables)*

● A clerical task is described involving the alphabetic filing of cards (50 Card Test or the Clerical Task). It is a short, easily scored test which may prove of potential value as a screening device for patients suspected of having organic brain disease; an objective measure of recovery from organic brain disease: the patients' clinical improvement to be correlated with the scores obtained on the Clerical Task and a means of assessment of intellectual functioning in children beginning with the age of 10 years and the fifth elementary school grade.

Requests for reprints and/or information should be directed to: Aaron Kameny, Rehabilitation Medicine Division, Montefiore Hospital, 210th St. and Bainbridge Ave., Bronx 67, N. Y.

Effect of Percutaneous Medication on Muscle Tissue: An Electromyographic Study. B. S. Post. *(pp. 791-798; 4 figures)*

● The question whether percutaneous absorption of medicine really occurs is an old one. Whether medicines applied to the skin have any effect on the deeper tissues, especially muscle, and whether they penetrate into and through the skin into the blood stream have long been debated. An effort to measure the effect of percutaneous medication on muscle with the electromyograph has been made, and the following conclusions have been reached: Percutaneous absorption does take place. Rubefacients applied to the skin do have a definite effect on muscle, increasing the time required to fatigue a working muscle.

Requests for reprints and/or information should be directed to: Bernard S. Post, M.D., 882 Flushing Ave., Brooklyn 6, N. Y.

Motivation for Recovery: Four Social-Psychologic Aspects. H. S. Rabinowitz. *(pp. 799-807)*

● Four psychologic factors are discussed as hypothetic aspects of patients' motivation for recovery during physical rehabilitation. These are the realism and clarity of their goal-striving aspirations; their acceptance of suitable value-standards and behavior patterns; their demonstration of adequate tolerance for frustration producing experiences, and their increasing degree of autonomy, as suggested by the development of more equalitarian feelings toward the hospital staff. A theoretic attempt is made to consider how motivation for recovery might be related to the operation of hospitals as social systems, in the light of research on hospitals and other institutions.

Requests for reprints and/or information should be directed to: Herbert S. Rabinowitz, Associate Director, Rehabilitation Center, 3701 Bellemeade Ave., Evansville, Ind.

Pathologic Disorders of the Hip and Shoulder Joints: Observations of Cadavers with Notes on the Pathogenesis of Osteoarthritis. W. H. Roberts. *(pp. 808-816; 2 figures and 2 tables)*

● With respect to the hip joint, osteoarthritis is certainly the most common pathologic disorder in the older age group. Ordinary wear probably is the principal etiologic factor. It is conjectured that thinning of the articular cartilages of the hip would result in some instability at first; a chain of pathologic processes is then set in motion which, in time, comes to limit motion. In other cases the parts may be reciprocally worn down into a conical shape; in such a case hip motion, particularly abduction, would be limited from the first. Chronic rupture of the supraspinatus tendon and capsule of the shoulder joint is relatively common in the older age group, the instability of the shoulder joint due to this cause may eventually lead to recession of the greater tubercle or frank osteoarthritis; if these are present the degree is proportional to the amount of retraction of the tendon and capsule. The findings came from a study of hip joints of 68 cadavers and shoulder joints of 85 cadavers.

Requests for reprints and/or information should be directed to: W. H. Roberts, M.D., Anatomy Department, Loma Linda University, Loma Linda, Calif.

Considerations of Intrasanatorial Functional Rehabilitation of Patients Suffering from Tuberculous Arthritis and Osteoarthritis. N. Haimovici-Hanes. *(pp. 817-819)*

● This paper points out that although the duration of the disease skeletal tuberculosis has been reduced and a number of cases can be healed with functional recovery, still a sufficiently large number of cases of osteoarthro tuberculosis still are healed only at the price of one or even several joints being sacrificed. The patient suffering from tuberculosis of the skeleton presents a number of special features: the disease chiefly affects children, adolescents and young adults; it implies the rigorous immobilization of the entire body or segmental immobilization over long periods of time; and it more often than not finally means the total or partial loss of the articular function because of the course of the pathologic process or of operative obstruction. From this latter point of view it is important to distinguish the patients who exhibit sequelae that merely prevent them from doing certain work and the disabled patients with multiple functional handicaps or handicaps involving important articulations. The latter are no longer able to make even half the effort necessary for normal labor. These and other considerations make necessary an occupation and qualifying therapy during hospitalization. An occupational orientation must not be forced upon the patient but must be deliberately acquired by him. Occupational and qualifying therapy as a main feature of intrasanitorial functional retraining is and adjuvant factor in the healing process and at the same time an important step in the series of methods applied for the patient's professional rehabilitation. Our efforts must be concerned not only with the healing of the disease itself but also with ensuring to our former patients conditions which will enable them to lead a normal life.

Requests for reprints and/or information should be directed to: Dr. Nicolae Haimovici-Hanes, Splaiul Unirii 179, Raion Tudor Vladimirescu, Bucharest, Roumania.

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2. Manuscripts **must be** in the office of the American Congress of Physical Medicine and Rehabilitation, 30 N. Michigan Ave., Chicago 2, not later than March 2, 1962.

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